Addis Ababa Institutes of Technology

School of Civil and Environmental Engineering

Stream: - Construction Technology and Management

Master's Thesis on

Study on the Challenges of DB Delivery System in Ethiopian Road Authority Project

By: - Sisay Lombasso Lolamo

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A Thesis Submitted to School of Graduate Studies in Partial Fulfillment of the Requirement for the Degree of Master of Science in Civil Engineering (Construction Technology and Management)

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Declaration

I, the undersigned, declare that this research is my original work and has not been presented for a degree in any other university. All sources of materials used for the research have been acknowledged.

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Abstract

The project delivery method is the process by which a project is comprehensively designed, procured and constructed. Design-Build is a method which an owner deliver both design and construction responsibility for a single firm. An important issue associated with Design-Build delivery method is that time savings, cost certainty and owner is free from both design and construction risks. Also it maximizes the contractor's ability to use innovative designs, materials, and scheduling, managing and construction techniques. While the single point of contact can be easier, the checks and balances that exist between the architect and contractor are missing, which can create conflict between the owner and Design-Build firms. It can be difficult to assess whether the best price has been achieved.

This research investigates the challenges of implementing Design-Build delivering process on Ethiopian Road Authority (ERA) projects. During conducting these research available documents relevant to the research were reviewed journals and articles, books, internet sources and archival document such as progress reports, completion reports, and contract documents. In-depth review of literature, desk study and case study are conducted and then an interview questions for each contracting parties are designed. The interviewees were asked face to face with interviewer. Then the data were analyzed for cross-checking the validity and conformity of the information obtained through the overall research work and literature review. This is followed by thorough discussions in order to draw a conclusion and to forward recommendations based on the findings of the study.

The research concludes that ERA's implementation of DB projects delivery system requires improvements on criteria or requirements to select delivery method, preparation before tendering and on administration during construction. ERA should focus heavily on the qualifications of the design-builder and its key team members rather than price or best-value procurement; and rewards design-build teams that have a demonstrated history of successfully collaborating on design-build projects.

Key Words: - Project, Design-Build, Design-Builders, Concept designers, Employer Representatives and Delivery system.

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Abbreviations

- A/E -- Architect/ Engineer
- AGC-- Associations of General Contractors
- AIA -- American Institute of Architects
- ATC -- Alternative Technical Concept
- BOT - Build Operate and Transfer
- BOQ -- Bill of Quantity
- CII -- Construction Industry Institute
- CM -- Construction Management
- CMGC – Construction Management General Contractor
- DB - Design Build
- DBB-- Design Bid Build
- DBIA--Design Build Institute of America
- EDRI - Ethiopian Development Research Institute
- EPC - Engineer, Procure and construct
- ERA - Ethiopian Road Authority
- ECoMPA - Ethiopian Construction Technology and Management Professionals Association
- FDRE - Federal Democratic Republic of Ethiopia GDP--Gross Domestic Product
- FIDIC - Fédération Internationale des Ingénieurs-Conseils
- GTP - Growth and Transformation Plan
- IHA - Imperial Highway Authority
- ICB - Internationals Competitive Bidding
- IPD- Integrated Project Delivery
- ITB - Instruction to Bidders
- LOI – Letter of Interest
- NCB - Nationals Competitive Bidding
- MoW&UD - Ministry of Works & Urban Development
- PPA - Public Procurement Agency
- PPD - Public Procurement Directive

- PDS- Project Delivery System
- PDSM - Project Delivery Selection Matrix
- RSDP - Road Sector Development Program
- RFP - Request f or Proposal
- RSDP- Road Sector Development Program
- RFQ - Request for Quotation
- SBD - Standard Bidding Document
- SOQ – Statement of Qualification

1. INTRODUCTION

Road plays crucial role to reduce transportation cost and support economic growth in the country, the growth of this industry is the tool through which a society achieves its goals of urban and rural development. It is important ingredients for the development of national economy. However, it is becoming more complex because of the sophistications of the construction process itself and the large number of parties involved in the construction process and construction projects faces difficulties to get completed according to the contract period [1].

Road is the dominant mode of transport in developing countries like Ethiopia and it plays major role in supporting economic and social development. Hence, improving the road network is regarded as one of the fundamental objectives towards the pursuit of campaign against poverty reduction. The Government of Ethiopia has well recognized that limited road network coverage and poor condition of the existing road network has been an impediment to economic recovery and economic growth. Therefore, to address the problems in the road sector; the Government has launched the Road Sector Development Program (RSDP) in 1997. Since then, four phases of RSDP were implemented over the period of 1997 – 2015 and the fifth phase; RSDP V has been implemented since July 2015. The development strategies which are fulfilled through successful road projects to import accessibility of rural areas, lower costs associated with transport maintenance and open more areas for development activities. Road projects, involving large amount of capital, also contribute to the total economy through job creation and in a ripple effect to other business activities [2].

Ethiopian Roads Authority (ERA) on behalf of the Federal Government acts as a client with the mandate of regulating the road sector. For road construction projects uses different delivering mechanisms, Design-Bid-Build (DBB), Design-Build (DB) and Build-Operate-Transfer (BOT). In traditional delivery method (DBB) Consultants give service like designing, supervising or technical assistances. Contractors do works associated with the construction, reconstruction, upgrading, demolition, repair or renovation of a building, road, or structure, as well as services incidental to works. The major financer in construction of road projects are the Government of Ethiopia i.e. government treasury and road fund, The World Bank, African Development Bank,

the Arab Fund, Kuwait Fund and other Multilateral and Bilateral Donors. The Government of Ethiopia takes the lion share in contribution for most of the road projects under construction [2].

Design-Build is one of a contracting approach used by ERA to deliver projects funded by the Federal Government. The Design-Build form of project delivery is a system of contracting whereby one entity performs both architectural/engineering and construction under one single contract.

1.1.Background of Ethiopia Road Construction

As introduced above development of road construction has a massive impact on national economy. The Ethiopian economy is highly dependent on agriculture, which accounts for around 50 percent of the Gross Domestic Product (GDP). Contribution of the construction industry to GDP at constant factor cost is about 6 percent for 2006/07. On the other hand, industry accounts for almost 12 percent of economic activity where most of the manufacturing firms are concentrated in Addis Ababa [3].

During the 17th and 18th centuries there were a number of small road trails and foot paths, in addition to the traditional shoulder porter age, animals like mules, donkeys, horses and camels were used as a means of transportation in Ethiopia

In the 18th century, especially during the reign of Emperor Tewodros, although the technology was primitive it was believed that planned road construction efforts were made. It is also believed that Emperor Yohannes IV, who succeeded Emperor Tewodros, was engaged in road building. However due to the danger of invasion by Egyptians, Sudanese and Turkish the Emperor was not able to achieve his desires [3].

It was prior to the second Italian occupation i.e. between the years 1896 and 1936 that a great success was made in road construction. Emperor Menilik was said to be a successful road builder participating himself in the construction. In 1903 the road from Eritrea to Addis Ababa and the road from Addis Ababa to Addis Alem were built. In addition it was during this time that the first Asphalt roads appeared in Addis Ababa (Organizational back ground of ERA, 2007).

During the Italian occupation roads were built by them and they were established to meet the requirements of the military control rather than to promote the overall development of the

country's economy. In addition, the roads lacked most of the modern design and construction features desirable for present day high speed traffic. The roads and trails built and improved during the 5 year Italian occupation were about 6000km. Approximately 2,500 km of them were given a single asphalt surface treatment, drainage structures were usually of stone masonry and at least three tunnels were built. When Ethiopia regained its independence, the Italians in their fleeing attempt almost undid what they created by blasting bridges and dynamiting roads [3].

The decade (1941-1951) after the Italian occupation is considered a period of stagnation for the construction and maintenance of the road system. During this post war period, it was felt that a grass root reunification and restructuring program of the already destroyed governmental organizations and systems was required which in turn accelerated considerable stagnation in the whole range of social and economic sectors. Significant magnitude of Italian built road network was deteriorated within a period of 10 years. In 1951 only 1000 km's of road was traffic worthy of the total stock of about 6000 km's.

In 1951, the Government established a strong and specialized road agency, the Imperial Highway Authority (currently called Ethiopian Roads Authority). The immediate responsibilities entrusted to the newly formed Authority were, first to rehabilitate the already deteriorated road network and second to construct additional road network.

From its year of establishment in 1951, the Organization managed to undertake various physical and policy issue assignments.

A program development of road started in 1951 with establishment of IHA. There were six highway programs [4], these were:-

A) First Highway Program (1951-1957)

Reconstruction and maintenance of 1525 km of badly damaged and 2686km of all-weather roads, Addis –Assab (860km), Addis-Jimma (355km) and Addis- Nekempt (331km).

B) Second Highway Program (1957-1966): - The program provided for the continued maintenance and improvement of 4500 km of main highways, for the construction of 800km of new roads and improvement of 1000 km of other existing roads.

C) Third Highway Program (1965-1968)

The construction of 700km of primary and secondary roads, 1000km of feeder roads and 1040km of asphalt surfacing works.

D) Fourth Highway Program (1968-1973)

During the Fourth Highway Program 820 km of new, primary and secondary roads was constructed. Out of the total program of the planned 2246km roads 1600km were completed

E) Fifth Highway Program (1974-1976)

In this program great emphasis was given to the construction of feeder road network to support the agricultural development, strengthening the institutional capability of the Road Agency and providing assistance to the local contracting industry. The program covered the construction of 539km of feeder road and 322 km of asphalt surfacing projects. It also involved the construction of road maintenance projects

F) Sixth Highway Program (1976-1978)

During this time the rehabilitation 284 km of primary roads, 280 km of secondary roads, construction of 809 km new gravel feeder road, 657km of service-to traffic and 1660km of rural roads were executed.

Beginning 1970, the program of rural road expansion was commenced with major emphasis to improving accessibility and mobility to agricultural potentials. Since its commencement the Ethiopian Roads Authority (ERA) has administered the road sector. ERA was established in 1967 by proclamation No 256/67 to provide for the control and regulation of travel and transport on the road. ERA is responsible for the use of all roads within Ethiopia, vehicles using these roads, and to all matters relating to road transport activities of the country. After the downfall of the military government, ERA restructured its obligations with a vision to ensure the provision of a modern, integrated, and safe road transport service to meet the needs of all the communities of a strong and unitary economic and political system in Ethiopia [4].

When we look at the road network of the country over the past five decades, compared to the year 1951 the total road network has increased with factor seven to reach the level in 2009. According to Ethiopian Development Research Institute (EDRI 2012), in 1951 the total stock of road network was only 6400 km; in 2009 that is 46812 km (ERA 2009). The rise in the length of

road is due to the emphasis given to the sector. In particular, the current government, the Federal Democratic Republic of Ethiopia, has placed increased emphasis on improving the quality and size of the road infrastructure. To address the constraints in the road sector, related to restricted road network coverage and low standards, the Government formulated the road sector development program in 1997. Since then, four phases of RSDP were implemented over the period of 1997–2015 and the fifth phase; RSDP V has been implemented since July 2015 [3].

RSDP I -From July 1997 to June 2002 (5 years plan)
RSDP II -From July 2002 to June 2007 (5 years plan)
RSDP III -From July 2007 to June 2010 (3 years plan)
RSDP IV -From July 2010 to June 2015 (5 years plan)
RSDP V - From July 2015 to June 2020 (Ongoing)

The fifteen years of the RSDP performance has brought significant improvements in the restoration and expansion of Ethiopia's road network. Physical achievements have been matched by significant improvements in the condition of the network, strengthening of the management capacity of the road agencies and delivery on policy reform.

1.2 General Objective

Studying challenges of implementing Design-Build delivery system on Ethiopian Road Authority projects and identifying gaps of implementation and forwarding potential recommendation.

1.3 Specific Objectives

1. Investigating ERA's implementation mechanism of Design-Build Project Delivering process and identifying challenges of Implementation.
2. Studying the effect of challenges on project construction (Schedule certainty, Cost certainty, and required projects Scope)
3. Assessing ERA's objective of implementing Design-Build delivery method.

1.4 Focus of the Thesis

This research focused on

- DB federal road projects which fully financed by Ethiopian Federal Government
- Study on projects handled by local contractors
- Addressed contractors participating on ongoing projects and completed projects.
- Projects administered by Ethiopian Road Authority (ERA).

1.5 Significance of the Study

There are different types of projects delivery mechanisms that have been practiced by ERA; DB is one of a contract delivering mechanisms which ERA is currently practicing widely. Owners are clearly seeing schedule, quality and risk as a significant incentive for using DB delivery system. As schedule were the most important criteria for choosing to use DB, shorten the duration on specific projects by merging the design and construction processes and delivering to single contracting parties. Similarly sharing risks of designing and construction and delivering good quality work at the end is major requirements of DB delivery system. It is also the objective of ERA to use DB delivery system for road projects

The significance or merit of this research is through identifying gaps and challenges of DB projects delivery mechanism implementation in Ethiopian Road Authority (ERA) projects and evaluating the objective of using the delivery system in terms of schedule controlling, cost controlling, change order and claim controlling futures, and forwarding possible recommendation how to manage the system and supports in order to achieves the intended objective of using DB delivery method for road construction and showing further studying area.

1.6 Motivation

Inspiration to conduct the research on this title is that usual delay of ERA road projects at different part of South Nation Nationalities and People region (SNNP). Through reviewing pertinent studies and discussion with professionals at different road projects and ERA head office employees' and one of the major cause of project delays is poor implementation of delivering process. Ethiopia Road Authority aimed to use DB delivery system for fast tracking, cost and time certainty, to share design and construction risks to Design-Builders, theoretically DB delivery method is preferable type of delivery method to achieve it. However DB projects

which implemented by local Contractors shows extra time overrun, some projects are terminated their contractual agreement and projects goes for another contract. I decided to study the gap on implementation of DB projects delivering practice in ERA (which is theoretically preferable delivery method to reduce these problems and related).

1.7 Research Question

The major objectives of Ethiopian Road Authority (ERA) using Design Build (DB) project delivery mechanism is to minimize schedule and cost overrun, minimizing design and construction risks, DB delivery method outperforms others in minimizing number of change orders, quality of end product with reduced rework.

This research answers the following research questions through investigating the challenges of DB delivery system in Ethiopian Road Authority projects.

- Does ERA's implementation of DB projects delivering process have limitations?
- If there is limitation? What are the effects on project constructability via original cost, contract duration, scope certainty of projects and effects on stakeholders?
- What are the remedial measures to fill gaps of implementation?
- ERA's objective of using DB delivery system is achieved?

2. Literature Review

2.1 Introduction

Construction projects are often implemented as a means of achieving an organization's and communities strategic plan, Civil engineering constructions are undertaken in project form having a predefined organizational and project goal [1].

Road construction is one of construction sector that directly relate to a community's economic health and quality of life. The demands on transportation facilities in Ethiopia continually grow, along with the competition for available funding and expectations of increased quality and higher levels of service. To ensure timely, efficient, and effective responses to these demands, approved projects may be delivered using alternative contracting methods, including the Design-Build contracting process. So that Ethiopian government is also constructing at different part of the country by delivering projects both to local and foreign contractors [5].

As the construction industry continues to grow in size and complexity, so do preparation and planning of project delivering and administering the project until completion. Appropriate practices of project managerial functions; proper projects planning and delivering of every element of a project, proper execution or implementations including controlling, and appropriate close-up of the project fosters project success; which can be measured in terms of schedule, cost and quality certainty. Any deviation in terms of the planned time, quality and cost will lead to argue that the project is not successful or failed to meet its requirement. So that owners always look for innovative and risk minimizing delivery method.

Conventional project delivery requires separating the design and construction processes and performing in-house design by the agency. However, involvement of the contractor in development of road (transportation) projects can lead to accelerated project delivery and cost savings for the national road authority [6].

Early involvement construction professionals reduce growing challenges between the speed of delivering new transportation capacities and the rapidly rising demand for transportation infrastructure. The Federal Highway Administration (FHWA) and other stakeholders have recognized that the slow pace of project delivery leads to increased costs, inefficient resource allocation, risks to overall economic vitality, and quality of life. Therefore, there have been

significant efforts at the national and state levels to utilize innovative project delivery systems to expedite project delivery.

In traditional projects delivery method, many competent contractors send low bids on projects just to keep work on their books, with plans to receive change orders once the project is underway; this practice is leading to cost and schedule overruns. Public projects across the United States are beginning to elect to use Design-Build (DB) as an alternate project delivery method over the traditional project delivery method of DBB in order to aid in reducing the cost, schedule, and change orders instead to increase innovation [7].

According to Lemma M. (2011) problems of traditional delivery system in Ethiopian Road Authority; mostly the constructability problem is occurring due to the designer is not responsible for the design risks, because designers may or may not part of contractual agreement during construction process and also ERA's control over designers contract obligation after procuring contractors is not strong. In case of Design- Build the contractor is responsible for both the design and construction hence he/she will check the constructability while designing.

In traditional delivery system most of the projects are exposed to variation and increased in initial cost, that the risk is absorbed by the employer. Due to variation the cost of the projects became higher as compared to the planned one. But in Design-Build projects the risk of design absorbed by the contractor. If the contractor follows the design manual properly the variations will be minimized.

ERA mostly uses traditional Design Bid Build delivery system, currently started using Design and Build method in some projects to reduce suffering from design problem and construction risks that could bring variation, claims, and disputes of traditional delivery method. And the most important reason is need of urgency for completion of projects for economic development of the country.

2.2 Types of Project Delivering Methods

Project delivery is the process by which all of the procedures and components of designing and/ or building a project are organized and put together in an agreement that results in a completed project. Project delivery is the contractual relationships between the owner, architect/engineer (A/E), contractor(s), and the management services utilized to design and construct a project [8].

According to ((owner's guide of project delivery 2003) and there are different types of projects delivering technique in the administration of civil engineering projects the most common ones and those widely used are discussed below [9; 10].

In Ethiopian Road construction the traditional delivery method (Design-Bid-Build) and innovative or Design-Build (DB) is widely practicing methods, sometimes ERA use Design-Build-Operate transfer system.

2.2.1 Design-Bid-Build (DBB)

The Design-Bid-Build delivery system remains the most frequently used delivery method for construction projects. Using this method, the owner engages a designer to prepare the design of the project, including construction drawings, and specifications. The designer also provides additional services including environmental investigation, permitting, Right-of-Way purchase documents, hearings for public approval, and submissions for project funding.

Once completed, the bid package, including the design and bidder's information packet, is presented to interested contractors, who prepare and submit their bids for the work. The owner will select a contractor, usually based on the lowest responsive and responsible bid (for most all public work), or some hybrid of price and technical merit. The selected general contractor will then execute contracts with subcontractors to construct various specialty items. The contractor is responsible for constructing the facility in accordance with the contract documents. The designer typically maintains limited oversight of the work and responds to questions about the design on behalf of the owner. If a CM is not involved in the process, the designer may also assist the owner in administering the construction contract, including determination of project progress, for validation of interim payments made to the general contractor.

Price is based on a specific scope of work. If the documents are poor or scope of work is undefined then the potential for change orders is extreme. This can lead to contract problems and litigation.

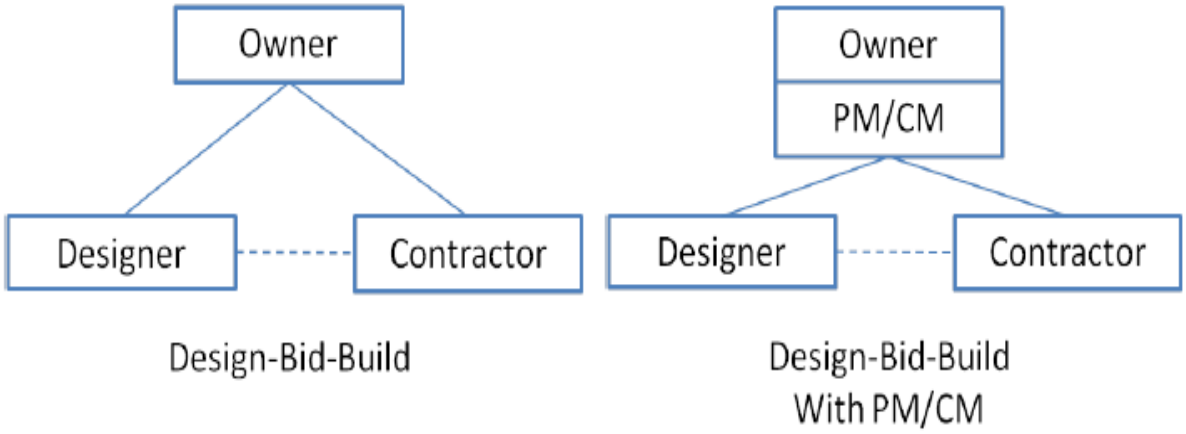

Figure 2. 1 Design-Bid-build relation

2.2.2 Design-Build (DB) or Turnkey

This form of contract delivering is a form of contract where the contractor is responsible for the design and building of the project. The design-build (DB) project delivery system has grown in popularity, and is seen by some in the industry as a solution for addressing the limitations of other methods. For an owner, the primary benefit is the simplicity of having one party responsible for the design and construction of the project. While the other delivery systems often give rise to disputes among various project participants, with the owner acting as referee (or party ultimately to blame), in DB many of these disputes become internal DB team issues which may not affect the owner.

Under this system, the owner contracts with a DB team, which can be a joint venture of a contractor and a designer, a contractor with a designer as a sub-consultant, a designer-led team with a contractor as a subcontracted entity, or a single firm capable of performing both design and construction. Since contractors are most comfortable in the role of risking corporate capital in performing projects, they usually are the lead members of this sort of team. One variation of the typical DB team structure, known as fee-paid developer, involves the owner engaging a developer, which then selects its own designer and contractor partners. However formulated, the DB team performs the complete design of the facility, usually based on a preliminary scope or design presented by the owner.

At some point early in the process, through a prescribed process, the DB team will establish a fixed price to complete the design and construction of the facility. Once underway, the DB team is then responsible for construction of the project, and for all coordination between design and construction.

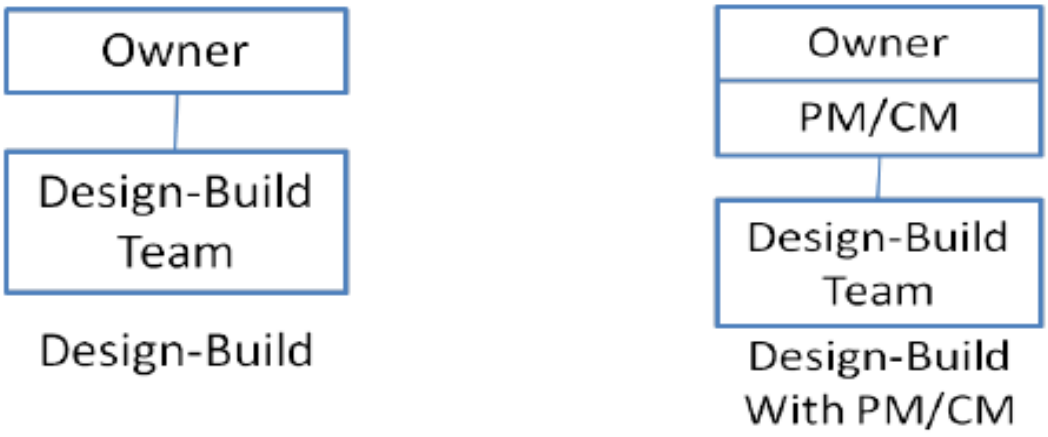

Figure 2. 2 Design-build relation

2.2.3 Construction Management (CM)

The Construction Management (CM) method of project delivery provides the owner with flexibility in selecting a contractor based on several factors other than solely on price. Those qualifications include project-specific expertise, history of performance and stability. Under a CM method of delivery, the owner selects the contractor based on qualifications and then the contractor's fee is negotiated. The owner has open book access to all project costs. This includes participation in the bidding and selection of subcontractors and vendors, which represents the most costly component of development. Throughout the course of construction, the construction manager basically serves as an extension of the owner's staff.

Many owners select CM knowing that the lowest initial price derived through the design/bid/build bidding process does not always ultimately turn out to be neither the lowest price nor the best value by the end of construction. When a project includes CM in the mix, the transition from design to construction is also more appropriate to be a smooth one. Within the overall label of construction management there are two different project delivery systems, with variances related primarily to pricing and contractual obligations, there are two types of contractual agreement: -

CM –At-Risk:-The CM holds the sub-contractor and vendor contracts, taking on the financial risk of the project by providing the owner with a guaranteed maximum price (GMP) for construction and a set date for completion, along with a negotiated professional fee (typically a percentage of the cost of construction) for the CM services. This GMP is best provided at the completion of the construction documents.

CM –Agency: - Under this form of CM, the owner holds all subcontractor and vendor contracts and the CM serves as an extension of their staff, managing all the contracts, but holding no financial risk. The risk is contracted with each prime contractor/subcontractor.

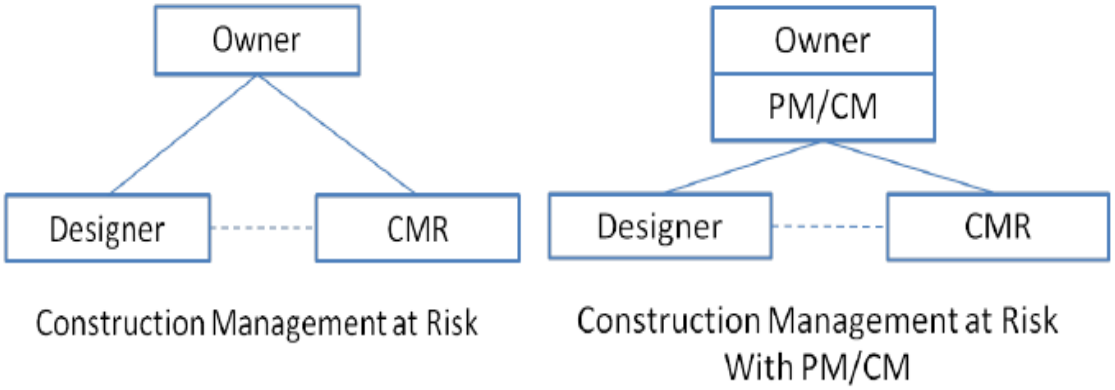

Figure 2. 3 Construction Management relation

2.2.4 Design-Build-Operate-Maintain Project Delivery System

Design-build-operate-maintain are a project delivery system that combines the design and construction responsibilities of the design-build project delivery system with operations and maintenance (FHWA, DBOM 2013). Procurement consists of selecting a design-build contractor that is responsible for design, construction, operation, and maintenance of the project. As shown in Figure 2.4, the public owner only signs a single contract with the design-build team who is responsible for all design and construction and long-term operation and maintenance activities.

In the design-build-operate-maintain process, the road authority identifies what it wants to be constructed, defines how it would like to see the facility being operated and maintained (e.g., level of service and acceptable performance), accepts proposals, and selects the design-build

team to assume the risk and responsibility for not only design and construction service but also long-term operation and maintenance activities. The design-build team, who is also responsible for operations and maintenance, is involved early in the design process in order to provide an opportunity for the designer to tailor plans to the capability of the design-build team from the operations and maintenance standpoint. Therefore, the design-build-operate-maintain team should consider the long-term operations and maintenance requirements during the process of design and construction.

The major difference between design-build and design-build-operate-maintain is the consideration of long-term performance requirements. New objectives will be introduced in the design-build-operate-maintain project delivery system, for instance, enhancing the long-term performance of the constructed facility and reducing the total life cycle cost of designing, building, and operating the facility. The design-build-operate-maintain-team has also the flexibility to be innovative, along with the greater responsibility and risk for the majority of the design and construction activities and all the operation and maintenance responsibilities. The owner, however, still keeps the responsibility for financing the project.

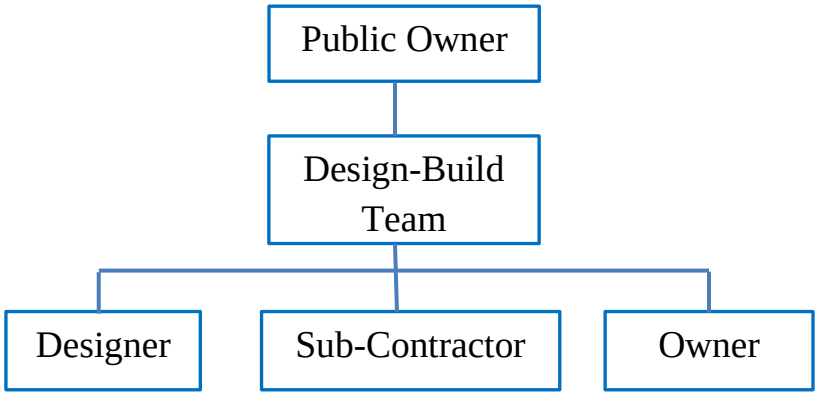

Figure 2. 4 Organizational Structure of Design-Build-Operate-maintain

2.2.5 Design-Build-Finance Project Delivery System

In design-build-finance, one contract is awarded for design, construction, and full or partial financing of a facility. As shown in Figure 2.5, organization structure is similar to that of design-build with additional short-term financing functionality.

In design-build-finance, the responsibility for long-term maintenance and operations of the facility remain with the public owner. This approach takes advantage of the efficiencies of

design-build, while allowing the public owner to completely or partially defer financing during the construction phase of the project.

Design-build-finance can be motivated by the owner's cash flow constraints or the owner's desire to defer payment for the project. In case of cash flow constraints, the public owner identifies what level of funding is available for the project at the time the procurement is released, and requires the design-build team to finance any development cost in excess of that amount over a specified period of time. In case of the desire to defer payment, the public owner issues a procurement asking the design-build team to provide the cost for developing the project today, with the payment of that amount promised at a later time. The design-build team may use different approaches to finance the cost of project development. In some cases, the design-build team provides self-financing to cover design and construction costs until the public owner is able to repay them. In the other approaches, the design-build team finances the costs through existing commercial credit lines or uses a combination of self-financing and borrowing. Whenever there is a need for substantially large financing amount over a long period of time, the design-build team may arrange project-specific financing tools.

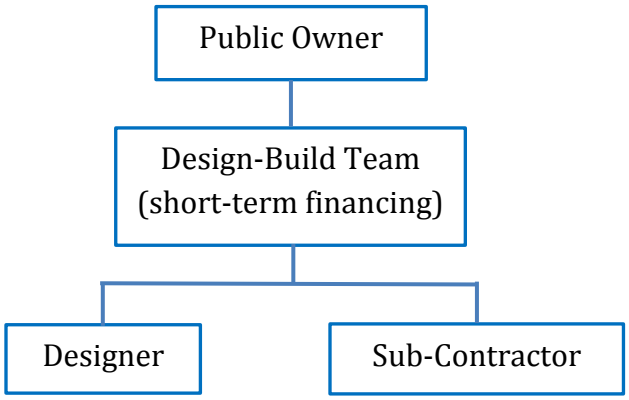

Figure 2. 5 Organizational Structure of Design-Build-Finance

The benefits of Design-Build-Finance are similar to those of DB, in that the public owner can capitalize on the efficiencies of having the design-build team undertake both design and construction activities. In design-build-finance, short-term financing of all or a portion of the project is assumed by the private sector. This allows the public owner to advance the construction of the project prior to assembling all the funding required for the project. The design-build-finance model is particularly beneficial when there is a short-term gap in financing

that can be overcome by the design-build team. Therefore, the public owner can expedite project delivery despite its short-term shortage in financing capacity.

2.2.6 Design-Build-Finance-Operate-Maintain Project Delivery System

In design-build-finance-operate-maintain, one contract is awarded for design, construction, operation, maintenance, and full or partial financing of a facility. As shown in Figure 2.6 the organization structure is similar to that of design-build-operate-maintain with additional financing (short-term or long-term) functionality.

Similar to the design-build-operate-maintain project delivery system, in the design-build-finance-operate-maintain project delivery system, the design-build team is responsible for long-term operations and maintenance of the facility. This approach takes advantage of the efficiencies of design-build-operate-maintain, while allowing the public owner to completely or partially defer financing of the project. The public sector takes advantage of the financial resource of the design-build team to finance the project. Financing can be complete or partial and short-term or long-term. Therefore, design-build-finance-operate-maintain project delivery system attempts to combine the advantages of both design-build-operate-maintain and design-build-finance project delivery systems.

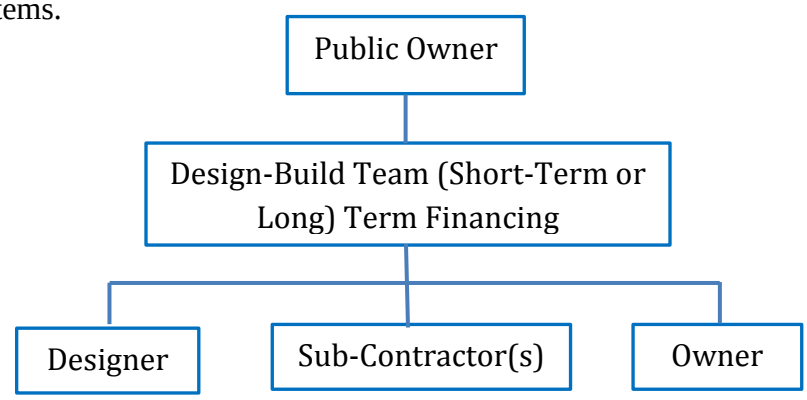

Figure 2. 6 Organization Structures of Design-Finance-Operate-maintain

2.3 Development of DB Delivery System and International Practices

Design Build is an alternative project delivery tool that will allow the flexibility to deliver selected projects more efficiently and cost-effectively by selecting a design-builder to complete the design and construction of the project [11]. This section introduces the background of design-build projects delivery system and practice of implementation in some countries briefly.

Appointing a single entity in charge of all aspects of a project is not a new concept. The concept has a rich history descending from the "master builders" or "master masons" of ancient Egypt, Greece, and Rome [12]. Master builders did not distinguish a project between its design and construction phases. They coordinated and controlled every aspect of a project including material procurement and selection, project design, supervising craftsmen, and project financing. The Renaissance brought about the first challenge to the idea of a master builder at the time of the most famous master builder Filippo Brunelleschi (1377-1446). Brunelleschi was commissioned to build the Gothic Cathedral of Florence in 1420 [13]. The master builders were challenged by Leone Batista Alberti, who believed in the separation of design and construction, when he published the first architectural printed work "De re aedificatoria" (On Edifices) in 1485. The popular view of a master builder remained in the majority until the industrial revolution.

The root of DB delivery method is largely flourished in the post-World War II era when DBB was already the established way to procure and deliver many types of infrastructure projects. It is not new concept to the building construction industry; it is relatively new to the highway construction industry. Interest in the DB approach by contracting agencies of highway projects has been encouraged by reported successes achieved in applying this approach to project delivery by other infrastructure development sectors in this country (for buildings) and overseas (for buildings and highways) [14; 15]

According to Owners Guide of Project Delivery System (2003) the rebirth of DB as a project delivery method for government-sponsored infrastructure projects can be attributed to a number of complementary factors

1) First, DB has its roots in the genesis of infrastructure development going back millennia when design and construction functions were integrated by the design-builder position.
2) Second, in times of war or natural disaster the urgency to expedite projects has caused government agencies to suspend traditional procurement and contracting methods and permit alternative approaches such as DB.
3) Third, budget and personnel shortages or other constraints in the public sector and competitive pressures in the private sector have caused project sponsors to seek more cost-effective ways to deliver projects. Indeed, fiscal and national crises have often

been the driving forces behind efforts to permit government to innovate and become more cost-effective.

DB projects delivering is widely practicing in the developed countries and dominated the traditional delivering mechanism in its nature of contract which promote time savings and usually provide for the shortest overall project time compared to other contracting methods, because the design phase can be shortened and the construction phase and design phase can be overlapped [16].

The US experience in the early part of the century (1800's), and for many years before, the architect was commonly the principal contractor for the building the trade guilds still flourished so the only way to include a whole building in one contract was to make an agreement with someone outside the trades and let him make sub-contracts with the trades. The person with whom the principal contract was usually made would naturally be the architect [16].

According to Engineering News Record ENR magazine, between 1995 and 1996 alone, the number of U.S. projects ($5 million and above) completed using design-build grew more than 100%. The most compelling statistic behind the surge in design-build acceptance and popularity has been by the year 2005, over 50 % of public and private construction projects will use this delivery method.

The FHWA has been allowing state DOTs to utilize innovative project delivery systems since the introduction of the special experimental project No. 14 (SEP-14) "Innovative Contracting" in 1990. According DBIA (2013), 45 State DOTs across the U.S. are authorized to use design-build and several are experimenting with construction manager general contractor (CM/GC) project delivery systems (DBIA 2013). Since the "Design-Build Contracting: Final Rule" became effective on January 9, 2003, the contracting practices by states DOTs have evolved. State DOTs with mature design-build programs constantly look for appropriate ways to optimize their current processes for project delivery. These State DOTs need to identify best practices and opportunities in various areas of project delivery and develop strategies that can help them deliver design-build projects more efficiently [17].

In China, the Design Build or EPC delivery system was first introduced in Petroleum and Chemistry industry in 1980s and then spread to other industries such as metallurgical industry,

electronic industry etc. In the petrochemical, metallurgical and electronic fields, most of the DB projects are delivered in EPC contract because of the high-technique requirements and the necessity for one entity to control the design, construction, procurement and commissioning etc. According to the statistics by China Exploration & Design Association, currently nearly 50 percent of the DB contracts are EPC pattern in these industries [18].

According to Mbanjwa and Basson (2003) empirical survey conducted indicates that the traditional delivery system was rated the most favored form of procurement systems, followed by construction management, management contracting ranked 3rd; design and build (turnkey) ranked 4th; and design and manage including (build, operate and transfer) ranked 5th. This shows that design-build is still not well understood in South Africa thereby affecting the way design - build is practiced and implemented.

England highways authority has advanced that project delivery method and using Design Build Finance and Operate (DBFO) procurement for all capital projects. Another method that the highway agency practicing is full delivery method, New Engineering Contract (NEC), the contractor and design team is brought into the process during the early initial pre-planning phase as a Variable Lump Sum contract, and then later on when the design can be formed into design documentation, a Target Price is negotiated. The service includes assuming responsibility for the operation and maintenance of a length of existing road (where relevant) and ensuring that specified construction scheme(s) along the length of road are constructed and made available to road users. The private sector is subsequently responsible for the operation and maintenance of the new sections of road. England high way authority formally launched to use DBFO delivery method, Private Finance Initiative (PFI) to procure road service on parts of the motorway and trunk road network in August 1994 [19; 20]

2.4 Design-Build Structural Variations

Structural variations are used to identify the role played by different parties in a design-build arrangement. Identifying the type of the design-build organization can be a factor affecting a potential relationship between the procurement of the design-build team and the project performance. According to Beared emphasized the importance of the design-build structural variations and how they relate to the structure of the design-build organization and the different arrangements undertaken within. There are five structural design-build variations [13; 21].

2.4.1 Owner and Joint-Venture Design-Builder

Following this arrangement, the owner contracts with a joint venture that consists of two or more parties joined together for the purpose of carrying out the design and construction services of the design-build project. The joint venture could be project specific, formed for the purpose of the project only; or temporarily formed, existing through a specific time period that covers the project duration.

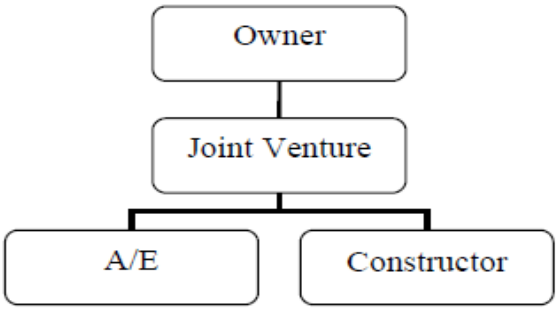

Figure 2. 7 Joint Venture Design-Builders

2.4.2 Owner and Constructor-Led Design-Builder

In this structure, the owner directly contracts with a constructor for all design and construction services necessary to complete the project. The constructor then hires a design consultant to perform professional design services through a subcontract arrangement.

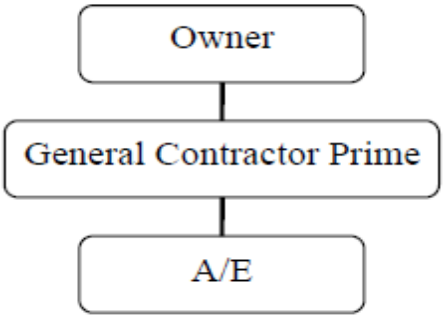

Figure 2. 8 Constructor-Led Design-Builder

2.4.3 Owner and Designer-Led Design-Builder

The owner signs a design-build contract with the designer. Construction services are performed by a constructor under a subcontract arrangement with the prime A/E. In this design-build

method, the A/E prime is responsible for the design services, maintaining construction cost and schedule, in addition to supervising construction methods.

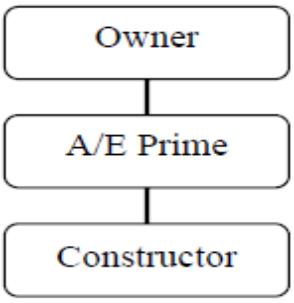

Figure 2. 9 Designer-Led Design-Builders

2.4.4 Owner and Integrated Design-Builder

The owner contracts with an integrated design-build firm acting as a single source of responsibility. The integrated entity provides direct contact with the design professional and the constructor.

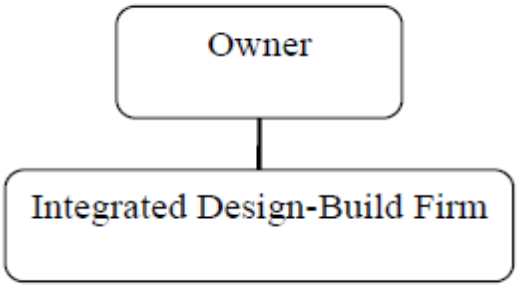

Figure 2. 10 Integrated Design-Builders

2.4.5 Owner and Developer-Led Design-Builder

The owner contracts with an independent developer to design and build the facility that will be owned and operated by the owner. The developer subcontracts the design and construction tasks to external designers and constructors.

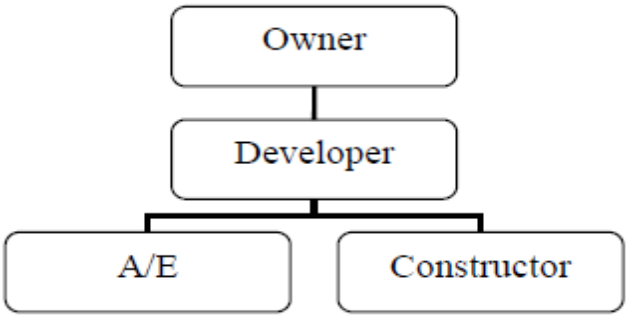

Figure 2. 11 Developer-Led-Builders

Depending on the project characteristics and national rule and regulation for specific project delivery mechanism, organizational structure is also varying. The relationship among contracting parties, level of responsibility, depend on organizational structure. Different countries use one or combination of the above organizational structure type.

Ethiopian Road Authority using the second, Owner and Constructor-Led Design-Builder structure, in this structure, the EAR directly contracts with a general contractor for all design and construction services necessary to complete the project. The general contractor then hires a design consultant to perform professional design services through a subcontract arrangement.

2.5 Design-Build-Operational-Variations

Operational variations for DB delivery systems refer to the level of design completion at the time of team procurement. These variations range from minimal design performed, reaching only 10%, to a preliminary design phase where the design completed amounts to 35%. This level is dependent on two factors. In some instances, the owner decides to achieve some design work prior to contracting with the design-builder, whether from within its organization or through an architectural consultant. Also, the owner's decision regarding when to communicate their requirements to the design-build team determines the amount of design work the Design-Builder will have to complete. It is a critical decision regarding the selected procurement method, affecting the project performance [21; 22]

2.5.1 Direct Design-Build

In direct design-build, the owner contracts with the provider of the design-build services at the earliest possible time during the facility development process. The owner or the design-build

team may develop a program and/or pro-forma. A direct design-build arrangement often results in the owner contracting with an integrated design-build firm, where the design-build team can assist the owner in defining their requirements and set a budget, through estimates and financial feasibility studies.

2.5.2 Design Criteria Design-Build

The owner sometimes, assisted by professional consultants, determines the facility criteria and the required performance standards. A Request for Proposal (RFP) may be developed where the owner sets out the criteria for the facility in clearly understood performance terms before contracting with a design-build entity. Following, the owner receives several design solutions from the different design-build teams.

2.5.3 Preliminary Design Design-Build

The owner, or their retained design consultant, performs a preliminary design to convey the project information graphically. This preliminary design information is included in the RFP for the design-builder's A/E to complete the design accordingly.

This operational variation is mostly applicable for a series of projects that should have similar layout and design and where the project should be completed based on the design concept provided by the owner.

2.5.4 Bridging Design-Build

In this arrangement, the owner contracts with a primary design professional to perform partial design that ranges from 30% to 80%. Afterwards, the design documents and the RFP are issued to the prospective contractors. This system is very similar to the traditional approach where the owner manages two separate contracts with the designer and the bridging construction firm respectively. The bridging contractor is expected to complete the detailed design, provide costs and value engineering services, obtain the necessary permits and finally construct the facility. Some advantages of this arrangement are the possibility of the owner's organization to maintain control of the project scope, while transferring the errors and omissions risk to the design-build firm. However, this system is characterized by several inefficiencies. It can be competitively bid in a very similar manner as the traditional approach. Furthermore, it eliminates the possible

innovation that should be associated with the design-build delivery system and does not necessarily allocate risks to the party in the best position to undertake them.

2.6 Advantage and Disadvantages of DB Projects Delivery System

2.6.1 Advantage

Proponents of DB contracting proclaim a number of advantages over traditional contracting arrangements [11; 23; 24].

Advantage through Time Saving

1) Early contractor involvement that enables construction engineering considerations to be incorporated into the design phase and enhances the constructability of the engineered project plans;
2) Fast-tracking of the design and construct portions of the project, with overlapping (concurrency) of design and construction phases for different segments of the project; and
3) Elimination of a separate construction contractor bid phase following completion of the design phase.

Advantage through Cost Savings

1) Communication efficiencies and integration between design, construction engineering, and construction team members throughout project schedule.
2) Reduced construction engineering and inspection (CEI) costs to the contracting agency when these quality control activities and risks are transferred to the design-builder;
3) Fewer change and extra work orders resulting from more complete field data and earlier identification and elimination of design errors or omissions that might otherwise show up during the construction phase;
4) Reduced potential for claims and litigation after project completion as issues are resolved by the members of the design-build team

ERA's Design-Build projects implementation progress indicates that, mostly projects indicates maximum time overrun, therefore ERA is disadvantaged through time saving. This is mainly due to poor scope definition before awarding projects to Design-Builders. In adequate scope definition ends with setting insufficient qualification requirements for tendering, so that ERA

selected unqualified Design-Builder. Most local contractors have lack of sufficient capacities and capabilities to handle DB projects. Back and forth for design request is the major challenge during implementation, these shows that communication among design firms and construction firms is poor; it is because of local Contractors have no sufficient design firms and they act as General Contractor, there is no pure Design-Builder in local condition.

ERA also spent extra amount of money for consulting firms in order to supervise. Project change request by Woreda and Zone authorities and projects alignment change and changes for town sections requests indicates ERA does not well prepare for DB delivery system.

Claim for cost compensation is lowest due to the nature of contractual agreement; it is a lump sum base, reduced potential for claims and litigation after project completion as issues are resolved by the members of the design-build team is major advantages through cost saving

2.6.2 Disadvantages

1) Subjective Contract Award (Reduced opportunities for smaller construction firms)
2) High Cost for Contractors to Prepare a Bid (Higher procurement costs)
3) Fewer competitors and increased risk may result in higher initial costs
4) Environmental permitting, utility relocation and ROW acquisition can be significant challenges
5) Agency limited in controlling (Minimal owner control of both design and construction quality). It shows elimination of traditional checks and balances or Designer is no longer agency's advocate. Quality may be subordinated by cost or schedule considerations.
6) Requires a comprehensive and carefully prepared performance specification
7) Design changes after construction begins are costly
8) No party is responsible to represent owner's interests

Design Build projects which implemented by local Design-Builders consist of all the above disadvantages, ERA's Design-Build delivery method is not beneficial or not achieved the intended organizational and project objectives.

2.7 Evaluation and Selection of DB Delivery System for Projects

The project delivery method is the process by which a project is comprehensively designed, procured, and constructed. The delivery method generally begins with the development of a project design and continues through the administration of the construction. The choice of delivery method influences many aspects of the project at different stages, including the: project scope definition, organization of contractors, designers, and various consultants, sequencing of design and construction operations, execution of design and construction, environmental approvals, testing, inspection, and Acceptance; and start-up and close-out procedures [10].

The choice of the project delivery system for a project is one of the most critical decisions that is made early on during the project planning phase and has significant impacts on the outcome of the project. This section review international accepted manuals or documents which guides implementation of DB projects delivery system for more efficient and effective practice throughout the project cycle.

Design-build is not the right project delivery system for every project. Each project has a unique set of goals and requirements that should be carefully analyzed and evaluated prior to proceeding with a specific project delivery system. Successful delivery of the project and achieving expected project goals depend on selecting a proper project delivery system that clearly defines contractual responsibilities for design and construction components of the project. The projects types needs to carefully evaluate the appropriateness of design-build for the project and ensure that combining design and construction phases is beneficial for the successful delivery of the project [21; 25].

Proper assessment of Design-Build for projects involves careful consideration of benefits, challenges and motivations regarding the use of Design-Build for the project. When deciding about the appropriateness of design-build project delivery system for a high way projects, the road authority should also carefully review the potential project risks and identify appropriate allocation and mitigation measures that should be adopted, in order to facilitate the smooth implementation of the design-build project delivery system [21; 26].

According to Federal High Way Administration (FHWA) formal Project Delivery Selection Matrix (PDSM) should be employed as a best practice to identify the appropriate method of

delivery for the project. FHWA and Design Build Institute of America (DBIA) noted several of the characteristics of Design-Build delivery by the PDSM as follow [14]

- Design-Build can expedite the overall project delivery schedule or the construction schedule.
- Design-Build can obtain aggressive project pricing with a process of innovation focused on cost-efficient solutions.
- Design-Build is most effective when funding available for design and construction of the basic project is known and set.
- Design-Build requires that the project scope of work and the desired performance be fully defined through a preliminary project design development and detailed Technical Requirements.
- Design-Build requires the project team to have the resources (usually including potential consultant support) to preliminarily advance the design and execute a formalized and extensive procurement process.
- After the procurement phase, the project team (often including consultant support) must have the resources to oversee the implementation (design and construction) of the project, including possible co-location requirements.
- To be most effective, the project risks should be well understood and definable and properly allocated between the owner and the Design-Builder.

DBIA recommend that using the PDSM methodology, these factors and more are considered in conjunction with other characteristics of traditional Design-Bid-Build (D-B-B) and Construction Manager/General Contractor (CMGC) to identify the best method of delivery for the project [27].

2.7.1 The Project Delivery Selection Matrix (PDSM)

The evolution of innovative contracting methods of project delivery such as Design-Build and CMGC has made it important to evaluate projects early in their development to determine the most beneficial method of delivery. Colorado Department of Transport (CDOT), the transportation industry, FHWA, and the University of Colorado have jointly developed the PDSM tool for assessing traditional D-B-B, Design-Build, and CMGC delivery for a given

project in order to select the delivery method most suitable for a project. Use of the PDSM is expanding throughout the transportation industry [28].

The PDSM manual provides the detailed methodology and worksheets to use for the delivery selection process, which is summarized in the narrative of this manual. It is a formal, documented approach for highway project delivery selection; the manual provides generic forms for use by road authority staff and project team members. By using these forms, a brief project delivery selection report can be generated for each individual project. The primary objectives of this document are to [29]: -

- Present a structured approach to assist project developing team in making project delivery decisions;
- Assist the owner in determining if there is a prevailing or an obvious choice of a project delivery method; and
- Provide documentation of the project delivery decision in a Project Delivery Decision Report.

The following figure indicates that Design Build Institute America and Federal High Way Administration's (FHWA) Project Scoping, Goal Setting, and Delivery Method Selection procedure [28].

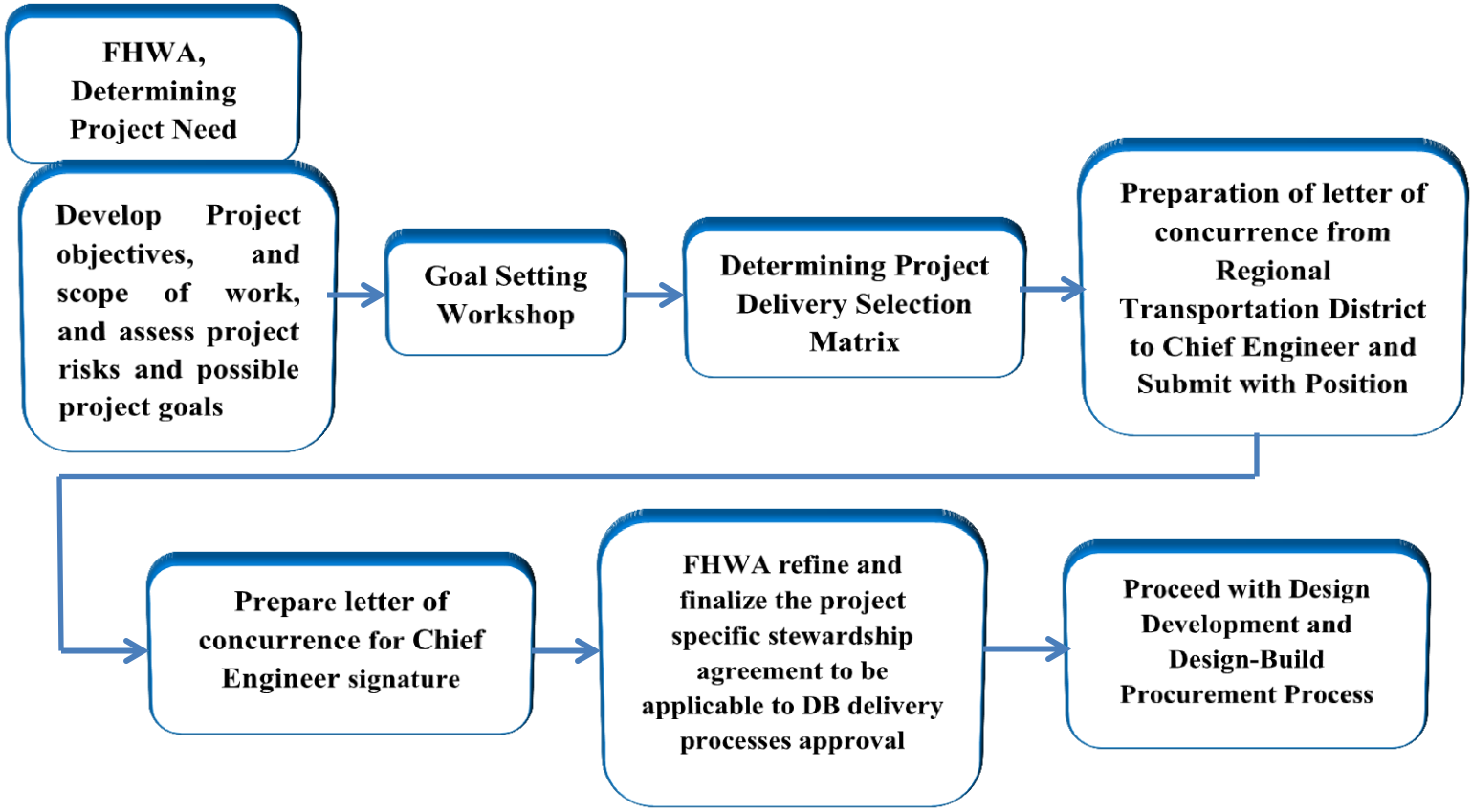

Figure 2. 12 Projects Scoping, Goal Setting and Delivery Method Selection

2.7.2 The PDSM and Design-Build Delivery Method

According to DBIA (2012c) and FHWA, There are eight factors to consider when using the PDSM approach to selecting the method of delivery. The PDSM process starts by evaluating four primary factors, followed by a risk assessment, which essentially constitutes a fifth primary factor. Usually, an assessment of the five primary factors determines the most advantageous method of delivery. The primary factors, as they are related to Design-Build are [22, 28]: -

I. Complexity and Innovation

Design-Build incorporates Design-Builder input into the preliminary design process through best value selection and contractor-proposed ATCs—which results in a cost-oriented approach to providing complex and innovative designs. For this approach to be effective Design-Build requires that desired solutions and outcomes to complex projects be well defined through contract requirements and, in particular, the Technical Requirements.

II. Delivery Schedule

Delivery schedule is the overall project schedule from scoping through design, construction and opening to the public. Project delivery schedule is one of Design - Build (DB) project delivery method evaluation matrix; it is a good opportunity to start or phase construction before entire design is complete, more efficient procurement of long-lead items and encumbers construction funds more quickly. Design-Build can get a project under construction before completing design. The parallel process of design and construction can accelerate the project delivery schedule; however, it may be difficult in local condition because of lack of design team for contractors. Procurement time can be lengthy due to the time necessary to develop the design, prepare an adequate RFP, evaluate Proposals, and provide for a fair and transparent selection process.

III. Level of Design

In Design-Build, the project design is advanced to the level necessary to precisely define contract requirements and properly allocate risk. The level of design is most commonly 30 percent or less but can vary by discipline as is necessary to define the scope and manage the risk.

Level of design is required to determine project scope prior to procurement to get accurate/comprehensive responses. Must have very clear definitions and requirements in the RFP - it is the basis for the contract. Level of direct agency control over the design and QA/QC requirements must be clearly defined [22].

IV. Project Cost

Designer-Builder collaboration and ATCs can provide a very cost-efficient response to project goals. Costs are determined with Design-Build Proposals, early in the design process. Design-Build can allow a variable scope bid to match a fixed budget.

V. Project Risk Assessment

Design-Build provides an opportunity to properly allocate risks to the parties best able to manage them, but it requires risks allocated to the Design-Builder to be well defined to minimize contractor contingency pricing of risks. Limited time to resolve risks, additional risks generally allocated to contractor and risk allocations due to unknowns may result in increased bid price.

VI. Market Factors

Market factors refer to the amount of competition in the market place and their capacity and experience to deliver the project, as well as availability of materials and equipment resources. DB selection is typically based on both qualifications and price, can promote teaming, design innovation, and price competition. Good opportunity for design customized to the contractor's unique resources and capabilities, and Cohesiveness of the design and the construction team throughout the project. Limitations are reliance on the design-build team that was awarded the project and limitation of availability of experienced contractors and consultants.

VII. Agency Factors (Owner Staff Experience and Availability)

Technical and management resources and expertise are necessary in Design-Build to develop the RFQ and RFP and to administrate the procurement. Then there is a concurrent need for both design and construction resources to oversee the implementation phase of the project. Experience and availability of the owner are viewed by a Design-Builder as risks and can influence the innovation a Design-Builder pursues during the Proposal period, either positively or negatively.

VIII. Third Party Coordination

Third party coordination is the involvement or activities to comply with regulations and clearances involved with items such as stakeholders, right-of-way permitting, environmental obedience and permitting, etc. Third party involvement can be managed by design- builder and agency has considerable involvement with third parties.

Gaining approval for projects design is not completed challenges to proceed without commitments for right-of-way, utilities, etc. Difficulty to define and achieve commitments on all third party requirements prior to issuing the RFP, possibility of changes by third party as design progresses, agency involvement with third parties may impact the Design-Build Firm's schedule and expectations.

2.7.3 Approval for Design-Build Delivery Method Use

Once an agency has completed a PDSM and written the report outlining why Design-Build has been found to be appropriate or most appropriate for the project, the resident engineer or the Project Manager must prepare one letter of concurrence from the Authorized Transportation District to the Chief Engineer, which should be supported by a project position paper.

2.7.4 Design-Build Projects Risk Management

Risk management is the identification, analysis, planning, allocation, and control of project risks. It is a central concept to Design-Build project delivery. The ability of Design-Build delivery to properly allocate risks to the parties that are best able to manage them is a key attribute of the delivery method. Through Design-Build delivery, risks that would otherwise reside with the owner in traditional Design-Bid-Build (D-B-B) instead can be assigned to the Design-Builder [30].

Not all risks should be passed on to the Design-Builder, as certain risks can best be managed by the owner. When risks that are best managed by the owner are passed through to the Design-Builder, often the result is an increase in contingency (risk) pricing for the project, or an unnecessary increase in the schedule for the project, or both. Improperly allocated risk can potentially jeopardize the success of the project by increasing exposure to claims and litigation. The advantages that Design-Build offers in managing risk can be recognized only through the proper allocation of risk [17].

Experience of Federal Highway Administration analysis in road construction projects is limited to subjective assessment that establishes incident for the project. The risk analysis and allocation begin by developing a systematic approach for appropriate assessment of risks that can affect the project cost, schedule, and quality.

The risk analysis and management process generally includes the following five steps:

1. Identify and discuss project risk.
2. Assess and analyze the risk.
   - What is the probability of the risk (high, medium, or low)?
   - What are the consequences of the risk?
3. Mitigate and minimize the risk.
4. Allocate the risk.
5. Monitor and manage the risk.

According to DBIA (2013); three issues arose in risk assessment and allocation of DB projects. The first issue was the duration of the projects from conception to completion: accelerating the process and avoiding delays. The second issue was a desire for greater cost certainty and control. The third issue was a desire to avoid what has come to be known as "claims contracting," in which a contractor bids the project at an unrealistically low number expecting to make up its profit on change orders. The agencies were concerned about this practice from a cost and quality standpoint, as well as the drain on their own internal management resources [25].

Economic risks related to price escalation managed by contracting parties is by using base price for some construction materials like cement, flexible bitumen (asphalt), fuel, which design builders included in their contract document. If any change occur it is assessed based on base price.

The lack of proper risk assessment processes and risk allocation tools negatively affect project outcomes. According to Daniel T (2012) 90% of large-scale transportation projects experience cost growth is results of poor risk management. Various risks, such design- and environmental-related issues can affect the project schedule and cost. Currently FHWA have developed proper risk assessment and allocation processes for transportation projects [27]. It is critical that Road

Authority develop risk management processes that can be used on transportation projects for proper analysis and allocation of risks.

There are several types of risk that can affect the outcomes of the Design-Build projects. The project management team should carefully identify major project risks with the assistance of subject matter experts from different offices involved in the Design-Build project delivery. Several major risk factors have been identified in road project risk management literature that can also be considered for Design-Build projects [31].

- Scope and goals; Issues associated with scope changes or additional scope driven by internal considerations
- Environmental issues; Risks associated with environmental impacts, studies, permits, approvals, and reevaluations
- Design; Potential changes to design criteria and specifications, errors and omissions, and design management
- Right-of-Way (ROW); Issues associated with identifying, coordinating, and securing the project ROW, and uncertainties in future real estate costs
- Utilities, railroad, and third parties; Issues associated with identifying and maintaining communication and coordination for successful reallocation
- Contracting and procurement; Changes in project delivery system, issues related to contract language, delays in advertisement, bid and award, market conditions, and changes in procurement method
- Construction; Project construction risks, issues related to quality assurance/quality control, construction permitting issues, differing site conditions, etc.
- Financial/Economic; Availability of funding, labor disruptions, financing costs, and uncertainty about material price escalation
- Force majeure; Risk of natural disasters, social disasters, and lawsuits against the project

Each Design-Build project is unique and has its own specific risk factors. The above list provides an initial risk template that can help road authority begin risk identification. The main challenge for the Road Authority is to develop a systematic approach to determine whether any of these

possible risk factors is applicable to the project under consideration. Also, the road authority needs a formal approach to identify any other risk factor that may be applicable for the Design-Build project.

2.7.5 Risk Register

The Risk Register is a tool used to guide and document the risk management process. The purpose of the Risk Register is to define the risks, document the risks, identify cost and schedule impacts associated with the risks, and produce mitigation plans for the risks. The project team should develop a Risk Register and refine it throughout the design development, procurement, and implementation of the project. Ideally, the initial Risk Register is developed as a part the project delivery selection, and it progressively evolves as the project is advanced through all of its stages to completion [29].

The Risk Register is not intended to identify all of the project risks, as that can require an extensive and potentially counterproductive effort. The purpose of the Risk Register is to assist the project team in the efficient management and allocation of risks. To that end, the Risk Register focuses on key risks that can significantly impact the project goals, costs, schedule, and performance.

2.8 Procurement Approaches

The Design-Build procurement process is one of most important phases of Design-Build delivery. It is important to recognize that the procurement phase is much more than selection of the Design-Builder for the project. It is a pivotal step in the design development of the project. It implements a collaborative process between the owner and the Design-Builder to advance the design of the project in a manner that both maximizes the project goals and provides the most cost-efficient designs to achieve those goals. During this phase, the owner advances the project by continued development of the basic configuration, the Reference Drawings, and the RFP Documents that guide the design of the project, and the Design-Builder develops a detailed Proposal that further advances the project design development. Together, the owner and Design-Builder collaborate on a refined design and a Proposal that reflects the values of the owner through a series of industry review meetings and confidential one-on-one meetings. These processes, unique to Design-Build, are key elements in recognizing the advantages that Design-Build delivery can offer in providing the most efficient and timely project.

According to Construction Management Association of America (2013) five main procurement methods that will be used to categorize the DB projects [9].

2.8.1 Sole Source Selection

This type of procurement method involves the direct selection of the design-build team without proposals. The lack of price competitiveness factor discourages public owners from selecting design-build teams using this procurement method [12]. However, the sole source selection potentially allows a shorter procurement time and thus, may be used during emergency conditions to ensure a faster project delivery.

2.8.2 Qualifications Based Selection

Using this method, the owner selects the most qualified design-build team through an RFQ and often negotiates only with that entity to a "fair and reasonable" price. Selection of the team is primarily based on qualitative criteria such as past performance, design-builder reputation, technical competence and financial stability. The later non-cost criteria represent 50% or more of the evaluation process. In this arrangement, owners may choose to award the project to a design-build team with whom they have established long-term relationships, with minimal scope design completed at the procurement time [32]. A negotiation process usually associated with this procurement method increases the probability for the design-build team of meeting the owner's quality expectations.

2.8.3 Best Value Selection

In a best value approach, the design-build teams respond to the owner by submitting proposals that are primarily evaluated based on the technical aspects together with the associated cost of the project [6]. Negotiations may take place after the proposal submittal phase. The owner selects the proposal that offers the best value. A weighting criteria evaluation method is usually used to identify the right design-build team and the weights assigned to each of the factors are specific of the owner's organization, in addition to the type and size of the project. The best value selection is advantageous because it also allows owners to prequalify the design-build teams based on technical criteria before the final selection phase, which is based on the price competitiveness.

2.8.4 Fixed Budget/Best Design Selection

The owner specifies the project budget during the RFP process [6]. The design-build teams compete by placing as much scope as they can in the submitted proposals. Using this approach, the design-build teams are selected based on qualitative and technical aspects, taking into consideration that the project cost is fixed for all competing teams. This procurement method is considered to be competitive regarding scope and quality rather than project cost. It allows the owner to have the optimum for the specified budget value.

The fixed–price approach, located at one end of the continuum shown in Figure 2.13 below, takes into consideration only the price as the sole criterion for selection. Accordingly, the lowest bidder is awarded the contract in an approach very similar to the traditional general contractors' procurement. In a one-step procurement procedure, the design-build team may be selected based on price only or a best value combination of financial and technical criteria [33].

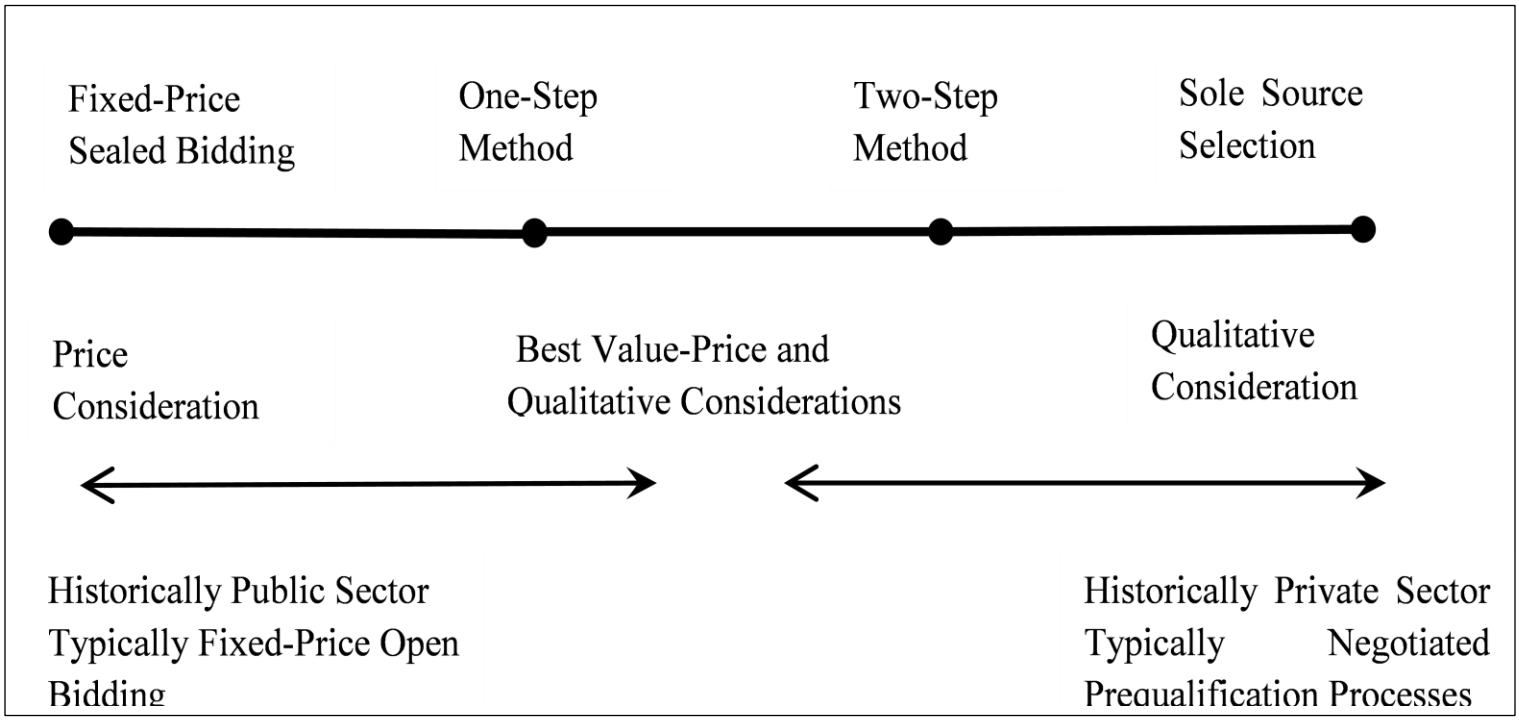

Figure 2. 13 Procurement Spectrums (Beard et al 2001)

2.8.5 **Low-Bid Selection**

The owner primarily selects the Design-Build team based on the project value and related cost items. Cost criteria represent more than 90% of the design-build team procurement selection process. This selection method is characterized by a high level of design completion at time of procurement to facilitate the competitive selection process [7]. However, innovation normally associated with the design-build delivery method may be reduced. Best value selection is more of formal discussions take place on both qualitative and quantitative factors in combination.

A two-step selection approach consists of a prequalification of the prospective design-build teams using a Request for Qualification (RFQ), followed by an evaluation of the price and technical aspects. This represents the "best value" approach and the weights given to each of the technical and financial criteria differs from one organization to the other. It is worth that management aspects, an organization's financial standing, in addition to previous design-build team experience are also considered in a best value procurement approach [34; 35]

According Federal High Way Administration manual the primary steps for Design-Build procurement process are:

i. **Issue a Request for Letters of Interest (LOIs):** Notify the industry of the upcoming procurement and define the field of Design-Builders that are interested in pursuing the project.
ii. **Issue a Request for Qualifications (RFQ)**: Solicit statements of qualifications and provide the industry with the basic definition of the project.
iii. **Receive and Evaluate Statements of Qualifications (SOQs)**: Determine the firms that can best meet the project goals and create the short list of firms to invite to participate in the Proposal process.
iv. **Issue a Draft Request for Proposals (Draft RFP)**: Provide proposers with a detailed near-final RFP to review and evaluate.
v. **Conduct Industry Review Meetings**: Solicit input from the industry on the Draft RFP to facilitate improvements to the RFP in response to industry concerns.
vi. **Issue a Final RFP**: Provide proposers with final procurement and selection processes and final Contract Documents that govern the design and construction of the project.

vii. **Conduct Confidential One-on-One Meetings**: Collaborate with potential Design-Builders to refine the design through development of proprietary Alternative Technical Concepts (ATCs), or allow them to modify the Basic Configuration with proposed Alternative Configuration Concepts (ACCs).

viii. **Requests for Clarification (RFC) and Addendums**: Provide additional clarifications of the RFP Documents and make modifications to the RFP by issuing addendums.

ix. **Receive and Evaluate Proposals**: Select the Design-Builder for the project.

The procurement steps represent the process of selecting the Design-Builder. However it is a long process, better to procure potential Design-Builder. According to FHWA and DBIA manual for procurement of Design-Builder is a two-phase selection procedure in that it involves LOI;

I. Request for Letters of Interest (LOI)

Request for Letter of Interest (LOI) is the way which Owner's communicates its intent to procure the Design-Build project. This communication effort informs bidders to solicit Proposals, and it establishes a process and opportunity for owner and partners to begin to exchange information, gain understanding, and measure interest. Release of information is prepared in a formal notice to the market as a request for LOIs. For Design-Build projects this request is advertised by being published for a fixed period time in a newspaper of wide circulation.

II. Request For Qualification (RFQ)

The RFQ process is the first phase of the two-phase procurement process for Design-Build delivery and it is sent to those companies or teams submitted a statement of interest containing the information required in LOI. The process is a two-phase selection procedure in that it involves SOQ and short-listing phase before the Proposal phase. This process should be followed for most Design-Build projects of significant size and complexity. It is a formal and structured process that must comply with federal regulations. The RFQ asks interested submitters to provide SOQ in response to criteria defined within the RFQ. The RFQ should not be issued until the completion of the minimum duration allowed for Letter of Interests (LOI), and then RFQ should be published to the SOQ submittal [28].

According to Federal high Way Administration manual, SOQ submitters should be offered opportunities for one-on-one meetings with the owner after the release of the RFQ. One-on-one meetings can be very valuable to the submitters for clarifying the project goals and needs to be addressed in the project. The meetings are most valuable when the owner's project team freely interacts with the submitters, as opposed to following a rigid outline of predetermined acceptable information to release. Care should be taken to ensure that contradictory information is not provided.

Then RFQ evaluation process continues factors that are identified for evaluation in the RFQ should correspond with the information that the submitters are required to provide in the SOQ with the evaluation and scoring criteria that the owner utilizes. It should include critical information to allow submitters to focus on those aspects of the project that the owner most values, such as Submitter Experience, Organization and Key Personnel, Project Understanding and Approach; Technical Approach and Management Approach and any specialized capabilities required for the project that assess the submitter's ability to perform the work. The criteria are weighted according to their relative importance to the successful completion of the projects.

Federal High Way Administration (FHWA) guidelines state three to five firms should be short-listed and invited to submit Proposals. The Design Build Institute of America (DBIA) recommends short-listing three firms in "Principles of Best Value Selection." Limiting the short list is important, recognizing the substantial level of effort that is required for Design-Build proposers to advance the design and prepare Design-Build Proposals. Limiting the short list strikes a balance between fostering competition and limiting the overall bidders' level of effort. The higher submitters perceive their probability of being selected, the more they are motivated to invest in their Proposals; these results in stronger best value Proposals from which the owner may select. Short-listing at least three firms provides the owner insurance so that if one firm withdraws, two firms remain to preserve a competitive selection process [21].

The short listed contractors are requested to submit Request for Proposal.

III. Request for Proposals (RFP)

Phase 2 of the procurement process for Design-Build delivery is initiated with the selection of the short-listed SOQ submitters that will be invited to submit a Design-Build Proposal for the

project. Phase 2 includes a critical step in the project procurement: the submittal and evaluation of Proposals leading to the selection of the Design-Build contractor.

The RFP is usually issued in two steps, first as a Draft RFP and then as a final RFP. This two-step process allows the short-listed proposers to provide input into the development of the RFP through a process that is referred to as "industry review." Proposer input into the development of the RFP can be beneficial in reducing project risks and improving best value. Proposers can identify Technical Requirements and contract clauses that are ambiguous or onerous and will result in risk pricing and/or potential claims. The owner then has the opportunity to revise the language to obtain stronger Proposals and minimize the potential for disputes. Changes to the RFP during industry review are global and go out to all proposers simultaneously. This is different than proposed changes as a result of the proprietary and confidential ACC/ATC processes that occur after the issuance of the final RFP [26; 28].

The industry review process primarily consists of one-on-one meetings with each of the short-listed proposers to solicit input on the Draft RFP. The Draft RFP should be issued enough in advance of the industry review meetings to allow the proposers adequate time to review the document. One set of review meetings is usually adequate to solicit RFP input; to develop a strong industry understanding of the RFP on large and complex projects additional meetings can be beneficial. Typical topics of the meetings are schedule, funding, third-party coordination updates, clearances, permitting, and ongoing investigations. Then after reviewing the documents proposers submit the final RFP [22; 29].

The final RFP process is more formalized than the Draft RFP process; industry comments and questions are addressed through the RFC process and additional changes to the RFP are made through the issuance of formal addendums. The release of the final RFP provides proposers with a high level of confidence in both the contract requirements and the selection criteria and process, allowing them to proceed with significant investments in both the design development and the Proposal development. At this point in the procurement process, proposers also develop ACCs and ATCs to propose to owner to provide best value benefits to the project.

IV. Awarding the Project to Best and Final Offers

Best value parameters are determined and weighted that reflects prioritized project goals. Each parameter is then scored, including the proposal price and schedule components. Often the technical parameters of the Proposal are qualitatively scored independently. After the technical scoring is completed, cost is independently evaluated and bidder who submitted minimum financial proposal is selected, and awarded the project to the best value parameters to obtain the final score.

2.9 Owners Contracting Alternatives

According to Owner's Guide to Project Delivery Methods - August 2012), Abebe D. (2013) and Marwa A. El Wardani (2015) procurement, contracting and compensation methods for professional services and construction services will generally fall into one of three categories:

- Fixed Price or Lump Sum (LS)
- Guaranteed Maximum Price (GMP)
- Reimbursable

These methods are not specific to any particular delivery method, and may be applied to contracting for professional services, such as design, engineering, and construction management, as well as contracting for construction services.

2.9.1 Lump Sum contracting

Lump sum contract is also called Fixed Price when an owner contracts with an entity to perform a fixed scope of work in exchange for an agreed lump sum payment for the specified services. This method is one of the most commonly used.

2.9.2 Guaranteed Maximum Price

Price contracting is an arrangement in which an owner contracts with an entity to perform a fixed scope of work in exchange for a price that is guaranteed to not exceed a stated maximum price. The GMP will typically include a base cost along with several allowances and contingencies that, depending on their ultimate use, may result in a final cost below the stated GMP. These "savings" may fall to the owner or may be shared with the entity providing the GMP.

2.9.3 Reimbursable Contracts

Reimbursable contracts come in a variety of forms, and are sometimes coupled with a not-to-exceed maximum price. With a reimbursable contract, an owner contracts with an entity to perform a fixed or variable scope of work in exchange for a payment based on some agreed calculation method.

During implementation of Design-Build projects it is expected some changes, the change order process in Design-Build delivery differs significantly from that in traditional D-B-B delivery. For the most part Design-Build contracts are lump sum based. Therefore, change order costs must be negotiated. The fact that the Contractor performs much of the design work further complicates the change order process. As part of contract management it is important that Owner maintain a conformed Contract that reflects any changes to the Contract Documents as a result of change orders, regardless of which party initiates the changes. Maintaining a conformed Contract ensures all parties are working off of the most updated Contract requirements throughout the implementation of the project. At the end of the project the conformed Contract becomes part of the final record of the project and reflects the administration of the project [31].

2.10 Practice of DB Project Delivering in Ethiopian Road Authority

In Ethiopian Road Authority (ERA), DBB delivery system is the most practiced type of delivery system in the road construction industry of Ethiopia since the 1987. After project owners did prepare the basic planning that identifies construction project programs, they call upon the participation of Concept Designers either by tender or by negotiated contracts. The consultant will carry out the design together with the necessary tender documents which will be the bases for tendering to select contractors [5].

In this type of delivery system, projects are divided into different packages interfacing to each other. Though the design and supervision consultant will be the prime professional on behalf of the owner and largely the administrator of the construction contract; the employer takes the responsibility of coordinating the various project packages and their respective interfaces.

Since the 1980, this traditional approach becomes less popular due to the several factors [36].

1. Severe Adversarial relations between the design plus contract administration consultant and the contractor.'
2. Fragmental contract for the project owner
3. Project owner responsibility for risks associated with the design and contract administration consultant.
4. Lack of impartibility of the Design and Contract Administration services.
5. The inability of design and contract administration consultants to cope up with new construction technologies and constructability issues of their designs.
6. Severe adversarial relationships between urban planners and Architects on the one hand; and Architects and Engineers on the other hand on building projects.
7. The indirect contractual obligation assigned for the Design and contract Administration Consultants
8. The incompatibility of consultancy fee to the desired activities they are required to provide.

From the above characteristics of traditional delivery, ERA found advantaged by using Design-Build delivery system are; minimized fragmented contract for design and construction, and design and construction risks transferred to Design-Builders. The rest of challenges also exist in Design-Build projects. Projects have adversarial relation between design firms (Design-Builders), and Woreda and Zone authorities on ROW on alignment changes, consultancy fees for ERA Representatives also escalates, and local Design-Builders are also found challenged to cope up with new construction technology constructability issues and they does not come up with innovation or Alternative Technical Concepts (ATC) to reduce projects duration and cost. ERA should revise implementation mechanism of Design-Build delivery method, and should properly plan and prepare sufficiently.

In the 1970s, large firms began to offer both design and construction services in order to provide project owners with a single source for project delivery. At the beginning, this delivery system was limited to complex projects such as industrial, big plants and big infrastructural constructions.

DB delivery system leads contracting firms to form a team or consortium of designers and specialty contractors who work together to meet the entire demands. Such services are initiated

after the project owner built the project concept during the basic planning phase and brought to the DB contracting Firms. The project concept should clearly define the performance criteria such as output, input, waste and any other performances the employer may desire. This makes Ethiopian Road Authority (ERA) to decide to give an additional responsibility to the contractor which is “fitness to purpose." Fitness to purpose is beyond the professional duty of care and places liability on the contractor for any failure of the design to perform the standards required [5].

When we look back to the history of road project delivery system which ERA had managed in the past, this could be the second time that it is bringing the DB system, the first one being implemented towards the end of the 1990s (Eshete M., ECoTMPA, April 2012). The choice should also consider the required project quality, safety, and owner’s involvement during both design and construction periods. The practice in Ethiopia, however, does not seem that these aspects are considered. Contractor’s capacity to discharge the contract responsibility should also be one of the criteria in adopting methods for project delivery. Majority of the construction projects are delivered using the traditional DBB method, there are also experiences on the innovative delivery methods that has been practiced in Ethiopia

But all projects shown in Table 2.1 below indicates time overrun (delay), cost incurred and some projects terminated, if the innovative project delivery method is properly managed it can really improve the situation which both the contractors and the owner were in. It is also possible to make a difference in the local construction industry [23]. Even though the DB project delivery method was practiced some twenty years back and suspended for a short trial, currently ERA is contracted and given out road projects on DB project delivery system to contractors for about 12 federal road construction projects.

According to (Abubeker. 2013) work, more than 15 projects were in progress, studied in five cases on DB projects indicate that there is about 0.28 % cost increment beyond the initially estimated cost and about 8.9% time overrun. This figure indicate that DB contract has small amount of cost and time increment, compared to DBB contract type, which is time overrun for projects is 28.2% and cost overrun is 32.6%. Relatively it is a good progress compared to the earlier projects.

Table 2.1 ERA's Previous DB projects (specific period of data1990-2000)

No.	Project's Name	Contract Amount (ETB)	Project execution at the end of the contract period (%)	Remark
1	Fik- Imi	69,341,713.00	84.8	Completed
2	Fissehagenet Konso	79,488,545.00	83.42	Maintenance Remained
3	Serdo-Afar-Haik	64,592,648.30	81.55	Completed
4	Delbo-Blate	10,606,800.00	80.22	Completed
5	Dawunet-Lalibela	70,926,413.00	78.97	Completed
6	Sawula-Usuno	32,931,274.00	76.5	Terminated
7	Assaitta - Dicootto	15,409,374.00	68	Partially terminated
8	Diri - Masha	68,263,545.00	63.45	Substantially Completed
9	Walmara - Guba	30,300,205.20	53.56	Contract Terminated
10	Akista - Tenta	31,847,451.44	50.32	Completed
11	Lalibela - Sekota	97,922,236.00	36.14	Completed
12	Alemketema- Akesta	48,951,661.00	33.87	Contract Terminated
13	Gog - Akoba	45,547,030.00	32.5	Contract Terminated
14	Gode - Hararghe	78,366,000.00	27.45	Completed

Source from Ethiopian Road Authority

According to Lemma M. (2006) it can be seen that design build project has an advantage of saving time and assure better quality and the current performance of the project is promising, it is ahead of schedule and all the design- build team members are involved in reviewing the design to ensure the quality of the product. Among the main reasons that ERA select DB from DBB is to finish projects on time, within budget and with better quality product in general it is early to evaluate the overall performance of the project [37].

According to Rahel T. (2016) Study on project delivery systems and their effects on cost and time overrun on Ethiopian Road Authority projects, projects which delivered in Design-Build system performs better with regard to timely and with budget completion when compared with DBB projects, and also the analysis shares the same stand with regard to burden reduction for Owner that DB is preferable than DBB. One of the benefits in DB delivery method is early determination of project cost. The system also transfer all the risks of additional work and design change issues to the Design-Builder, so all additional costs if any will be covered by the contractor but projects price adjustment contribute millions of ETB above the contract amount which contribute for the 36% increase (selected projects), and according to the study DB projects

cost and time overrun frequently happening because variations are the main reasons for cost and time overrun. Also late submission of design and late approval, ROW issues, late mobilization and commencement of the work and lack of experience on local contractor are the main causes of delay in DB projects. Respondents also strongly agree to use DB delivery method for road projects, and better to entertain DB for complex and shorter time projects with a need of minimized risk [52].

ERA is suffering from design problem that could bring variation, claims, and disputes in traditional delivery system. On difficult terrain conditions and areas prone the different challenges such as land slide is better to exercise DB tender type. Constructability of the design and value Engineering are also another issues. In this case the employers can transfer design risks to the contractors and flexibly in design are main advantages. Besides the above reasons the need for early completion of some of the projects for economic, social or other reasons is the other motive for selecting DB strategy.

However literatures shows strong point of DB delivery system, Ethiopian Road Authority professionals tell that currently projects are requiring exaggerated additional time beyond the contract schedule, the time overrun consequence cost overrun and other related problems. I tried to see progress report of some projects under construction, which are beyond contractual schedule. Here implementation mechanism of DB delivery method is discussed through conducting desk study. For the desk study archival documents like procurement methods, selection mechanism, performance managing mechanism, completion report, progress report, and contract documents, specific rule and regulations for DB projects are used as data source.

2.11 Design-Build Projects Delivery Strategy

Exploring ERA's DB projects delivering practice and process from the procurement manuals and archival documents is one of the specific objectives which provides good insight to identify the gap on projects delivery system and the information which heads to identify problems encounters during the course of implementation due to the gap of delivery process. The negative effect on projects performance and on stack holders is also addressed in the study.

ERA’s DB projects delivery strategy begin by identifying the road project needs by its Planning and Programming Directorate as per the priority of the roads and the available budget for the

projects in which their designs are completed (for DBB projects) or conducting Concept design (for DB projects) [38]. In ERA, the DB project's scope design and tender documents are prepared by a design consultant or concept designers.

Then all eligible bidder or short-listed consultants invited to submit proposals based on the request for proposal. Qualified and least bidder consulting firms selected for concept designing of DB projects. The concept designer's service includes "prepare the Concept Design, Environmental Impact Assessment, Resettlement Action Plan, Risk Assessment, Request for proposal document and Concept designers estimate for Design and Built project cost and project duration. Then the Planning and Programming Directorate forward the lists of projects to the Engineering Procurement Directorate to start their procurement process.

Based on concept designer's project information Engineering Procurement Directorate will invite eligible design builders for bidding by announcing different media. These depend on the priority of projects and availability of budget.

Engineering Procurement Directorate then prepares a procurement plan which indicates a schedule of main activities to be carried out in the procurement process. Since the project is handed over to procurement directorate after identification and completion the projects concept design, the procurement plan will have nothing more than the schedule of main activities to be carried out in the procurement process.

The design builders will prepare their bid, as per the required scope of the project, the complete required documents of the project including defining the project scope and preparation of the required technical and financial documents.

2.11.1 Biding Method

Ethiopian Federal Government Procurement and Property Administration Proclamation No. 649/2009 that entered into force on the date of publication in the Federal Negarit Gazeta No. 60 on 9th day of September, Article 33 Section 2 restrict public sector clients' to use open invitations in which all contractors are welcome to submit bids unless a stated special reasons. The Federal Public Procurement Directive states the total contract value of a procurement of works made by restricted bidding shall not exceed ETB 2 million. However, ERA is unable to

use this method of procurement as most of the projects handled by ERA are larger than ETB 500 million and even above billion[38; 39]

Therefore, ERA does not use alternative procurement procedures other than the open bidding for DB projects. As a public body, ERA for all DB projects uses open tendering as all of contracts are more than the maximum limit provided in the directive. Using open bidding is not bad by itself, but it is better if used two phase selection mechanism; Request for qualification and Request for Proposal to award the project to qualified design-builder.

2.11.2 Selection Mechanism

The selection mechanism for all Government financed road projects in ERA is a two envelopes System or (use Post-qualification as means of procurement), similarly DB projects contractors are selected in the same way where the envelopes containing the qualification of the bidder first opened and the envelopes containing the financial bid of all bidders put unopened. The financial bid will remain sealed and kept carefully under the custody of the Deputy Director General until the second bid opening preceding. However, for other international financed projects, either pre-qualification or one envelop post qualification is being used [40]. ERA's using Post-qualification as means of procurement is not indicated in any of the directive except the directive indicated public bodies to use open bidding as the preferred procedure of procurement in a similar sense as of post qualification.

Two envelop bid system has an advantage in decreasing the procurement lead time and collusion between bidders as compared to pre-qualification and also avoids possible difficulties rejecting low bids from unqualified bidders as compared to post qualification. However, using two envelop system will result expense of preparing a bid for unqualified bidders and bidders will not able to bid with the knowledge that they are competing against able and qualified bidders.

2.11.3Risk Allocation in Tendering

The conditions of contract that have been used are FIDIC Conditions of Contract for Design-Build/Turnkey Projects First Edition 1995; it indicates a lump sum contract agreement. Form of contract is the best place to allocate risks in order to promote project implementation on time and on budget with specified quality in the contract that is to obtain the greatest value of money. One of the basic risks in construction contracts is managing the economic risks and in conditions of contracts like price escalation clause is used to manage such economic risks.

Economic risks related to price escalation managed by contracting parties is by using base price for some construction materials like cement, flexible bitumen (asphalt), fuel, which design builders included in their contract document. If any change occur it is assessed based on base price.

Problem related to price escalation is absence of a local indices and the authorized institution. i.e the Ethiopian Statistics Authority do not prepare indices for labor, cement and fuel etc. In developed country like USA and some developing countries like Uganda, India and China there are institutions for the preparation of indices. Hence, for local inputs ERA is obliged to use price quotation from suppliers as a base price in adjustment [41].

During tender evaluation there is no mechanism for checking the authenticity of the supporting documents that indicate the base prices/indices. The only thing what staffs in ERA do is checking the papers (the source of price/indices and the price).

Moreover, there is no mechanism to check the reliability of the supplier. In such circumstances, contractors may give small base price by communicating with suppliers; and sometimes they may come up with base prices from the suppliers which they think would benefit them according to its trend of increasing.

2.11.4 Qualification Criteria and Performance Evaluation

A. Qualification Criteria

Qualification criteria for design builders in ERA are generally measured by their technical ability and capacity of the bidder to perform the intended projects by means of established minimal capacities below.

The major criteria include: -

- Financial capacity (turnover, cash flow and historical financial performance like current soundness and long term profitability)
- Experience (general and specific to the project)
- Performance of the contractor in ongoing projects and
- Technical capacity of contractor, Key personnel required for the execution of the works and availability of machineries

- The work schedule and construction methodology presented for the execution of the works is also assessed.

ERA sets qualification criteria for project financed by the Ethiopian Federal Government based on the framework set by its board. The framework states the factor for each required criteria by dividing it into local and foreign bidders and international and national competitive bidding. The essential criteria i.e. turnover, cash flow, general and specific experience as detailed in Table 2.2 below. There are no specific qualification criteria for DB projects particularly.

Table 2.2 Revised PPA Qualification Criteria among World Bank, PPA and ERA (2016 Edition)

No	Qualification Criteria	World Bank's SBD	Revised PPA Qualification Requirements		
			Normal projects		Capacity building projects (dedicated to Locals bidders only)**
			For locals	For foreign	
1	Annual const. turnover (ACT)	ACT= Engineer's Estimat / Contract period in The multiplier F=2 may be reduced for very large projects (>200US$) but shouldn't be less than 1.5.	AT(Peak)= Engineer's Estimate ∗ F / Contract period in yrs F=1	AT(Average)= Engineer's Estimate ∗ F / Contract period in yrs F= 2.	AT(Peak)= Engineer's Estimate ∗ F / Contract period in yrs F = 0.2 however, it shouldn't exceed 15 million ETB
			• In case joint venture formed by local and foreign bidders, the multiplying factor F will be 1.5 and the required annual turnover will be average of the last five years • If bidders submit their bid in Joint Venture (JV), the construction turnover requirement for each partner (members of the JV) shall not be less than 25%; while for the lead partner of the JV shall not be less than 40%. • The value of total certified payments received in each year shall be adjusted for inflation of Birr value through multiplying by Cn/Co factor, where Cn is value of 1 Dollar in Birr on the 28 day prior to bid submission date and Co is the value of 1 Dollar in Birr computed using the exchange rate prevailing on the last date of the respective fiscal year. • The basis of computing Dollar value of Birr shall be the selling exchange rate issued by the		

			National Bank of Ethiopia		
2	Liquid asset/cash flow requirement (CF)	CF= Engineer's Estimate∗ F / Contract period in mon Factor F should not be more than 4 months.	CF= Engineer's Estimate∗ F / Contract period in month Factor F = 3	CF= Engineer's Estimate∗ F / Contract period in month Factor F = 4	CF= Engineer's Estimate∗ F / Contract period in month Factor F = 3
3	General Const. experience		A minimum of 2 years' experience under const. contract in the role of contractor, Joint Venture partner or subcontractor. All categories of contractors from grade 6 to grade 10 are exempted from this requirement	A minimum of 5 years' experience under Const. contract in the role of contractor, Joint Venture partner or subcontractor	2 years general experience in construction
4	Specific const. projects experience **i)** Number of projects **ii)** Value of the project **iii)** Nature, Complexity & Similarity of Projects	**i)** 1 to 3 contracts normally 2 depending on the size and complexity of the subject contract, the exposure of the Employer to risk of contractor default, and country conditions. **ii)** 80% of the estimated value of the subject contract. **iii)** Similar to the proposed works. The similarity shall be based on the physical Size, complexity, methods/technology.	**i)** successfully and substantially completed at least one similar contract within the last 10 years as contractor, Joint Venture partner or subcontractor **ii) Value** **a)** with a value of at least 70% of the estimated value of the subject contract; **b)** When the estimated value of the subject project is below 1 billion Birr, bidders can present two projects, to meet the requirement in 2 (a) above, each with a value of at least half of the requirement	**i)** successfully and substantially completed at least two similar contracts within the last 10 years as contractor, Joint Venture partner, management contractor or subcontractor **ii)** with a value of at least 80% of the estimated value of the subject contract; **iii)** works of a nature and complexity equivalent to the proposed Works	Experience in completion of at least one construction project of any nature with at least a project cost of ETB 15 million.

Part of the Table 2.2 (No. 4)

When the estimated value of the subject project is equal or above 1 billion Birr, bidders can present three projects, to meet the requirement in 2 (a) above, each with a value of at least one third of the requirement

One level below the standard of the intended project or higher level with the following differentiation (Basis of classification for similarity of projects shall surfacing material and length for road, span length for bridges as shown in the Table 3.2. Requirement for Local contractors shall be one standard level below the requirement of the subject contract.)

- A project is considered as substantially completed if its progress is 70% and above.
- As a proof of successful and substantial completion of contracts the Bidder must provide Certificates from previous contracts and/or experience provided by the other contracting party.
- For contracts under which the Bidder participated as a sub-contractor or a joint venture member, only the Bidder's share, by value, shall be considered as specific experience.
- Contract value of projects referenced by the bidder shall be adjusted for inflation of Birr value through multiplying by Cn/Co factor, where Cn is the current value of 1 Dollar in Birr taken 28 days prior to bid submission date and Co is the value of 1 Dollar in Birr at the date of signing the contract. The basis of computing Dollar value of Birr shall be the selling exchange rate issued by the National Bank of Ethiopia.

Part of the Table 2.2 (No. 5)

Revised PPA Qualification Criteria among World Bank, PPA and ERA (2016 Edition) includes Historical contract non – performing records for both local and foreign design builders. Any local contractor's performance shall be evaluated based on the ERA's contractor's performance assessment framework and rated accordingly. The minimum acceptable performance on ongoing contract shall be revised to reflect the actual situations. The minimum acceptable performance on ongoing contracts is set time to time by ERA board.

Part of the Table 2.2 (No. 6)

ERA require local contractors legal status, Major Equipment, Key Personnel, Proposal for sub-contractors, proposal of work method and program, current contract commitment and declaration of site visit and understanding of the work are required to fulfill. Historical financial performance and pending litigation are required (Must Meet).

B. Performance Evaluation

In works contracts of government financed projects, one of the major qualification criteria is performance assessment of bidders on ongoing projects. For bidders having ongoing projects with ERA, the performance assessment will be carried out is shown in Table 2.3 below indicated procedure (formula). If bidders do not have projects with ERA, the performance assessment shall be carried out following qualitative assessment of bidder's performance based on written feedback from their employers. The performance assessment is carried out every calendar month. Under each evaluation, the performance of the bidder in the immediate previous month (from the date/month of deadline for submission of the tender in reference) is used for evaluation. *(Performance Evaluation of Contractors under Government Financed Tenders 2016)*

Table 2.3 Performance Evaluation Formula for Local Contractors

Contract Period	Minimum expected progress	For the intermediate months	Remarks
First (1/3)rd	9%	9(t1)	$t1=\frac{(\text{Time Elapsed} - \text{Mobilization Period})}{(\text{Total contract period}/3 - \text{Mobilization Period})}$
Second(1/3)rd	38%	9+29(t2)	$t2=\frac{(\text{Time Elapsed} - 2 * \text{Mobilization Period})}{(\text{Total contract period}/3)}$
last (1/3)rd	70%	38+32(t3)	$t3=\frac{(\text{Time Elapsed} - \text{Mobilization Period})}{(\text{Total contract period}/3)}$
Beyond Contract period (1/4 of the contract period)	Expected to be completed 100%.	70+30(t4)	$t4=\frac{(\text{Time Elapsed} - \text{Mobilization Period})}{(\text{Total contract period}/4)}$

The above qualification criteria is performance assessment mechanism of local bidders on ongoing projects, but it seems more general and does not considered actual project condition and local Design-Builders capacity and capabilities. Most projects those handled by local contractors found difficult to attain the required level of the Minimum expected progress requirements. However ERA set the above formula, evaluates Contractor's performance on ongoing projects is solely based on financial progress and duration of projects, forgetting overall management of projects and formula used for calculation of the expected performance of contractors, is not in line with the actual expected cash flow progress. It is made in monthly basis and may results contractors to focus in fulfilling a performance requirement of a specific month based on the intention to participate a specific tender and non-uniform disqualification of contractors.

C. Expected Performance for Three or More Projects

It is clear that as the number of projects that a given contractor can handle at a time increases, it does have an impact on the technical and managerial efficiency of the contractor unless and otherwise the contractor take some positive measures to reduce the negative impact resulted from the increase in number of new projects. On the other hand, employers would take risks in giving more number of new projects the contractor; in so doing contributes to the contractor's inefficiency. Hence, in order to manage the risk of inefficiency due to increase in number of projects, it is suggested to raise the expected performance of a given contractor by a certain percentage if he has three or more contracts at his hand *(Performance Evaluation of Contractors under Government Financed Tenders 2016)*. Hence the formula developed to determine the additional percentage of expected performance is:

$$= 2 * (1.5)^{n-3}$$

2.11.5 Bid Awarding

Awarding DB projects contracts in ERA is typically based on the low bid method. According to this method, the construction firm who is responsive and submitting the lowest bid receives the right to the construction contract. The major drawbacks of the low- bid method is the possibility of awarding a construction contract to a contractor that submits, either accidentally or deliberately, an unrealistically low bid price. Often, such an occurrence works to the owner's and contractor's detriment by promoting disputes, increased costs, and schedule delays.

2.11.6 Implementation

After the Contractor is selected in the procurement phase of the project, the project enters into the implementation phase. The term "implementation phase" is used instead of "construction phase" because the phase includes both design and construction elements of the project. These two elements of work are usually performed in parallel (overlapping) schedules, which results in project management processes that are unique to Design-Build delivery.

2.12 Challenges of Using DB in Ethiopia

DB project delivery is one of the many different types of project delivery systems that are being practiced by many public and private project owners in many countries worldwide. When it is observed back at the history of road project delivery system ERA delivered different projects Design-Build delivery system, moreover currently practicing the delivery method widely.

Design-Build is a tool that with proper application can dramatically reduce the delivery time of large, complex, schedule-driven projects. Like any tool, however, one can also misuse it. Owners should understand the Design/Build process and make an informed decision before selecting this project-delivery method. An owner that selects Design-Build should be aware of the implications of its decisions and actions through a good understanding of the consequences from the Contractor's perspective. Experienced Design-Build consultants and Contractors are available to further explore specific issues, and owners should consult them for additional information. By following these principles an owner can maximize the chances of finishing the project 'on-time' and 'on-budget' [42].

The first one being implemented towards the end of the 1990s, during that time about 14 projects were given to contractors with end results that have not made both the client and the contractors happy [37].

Although ERA might have its own reasons for abandoning the system after only a short trial, it has currently given about 12 projects for contractors on DB system thus waiting to see how it ends. From the information gathered, some of the contractors involved in the first package were not happy in the outcome since the prices they offered did not cover their expenses. Some of them complained that they have encountered different site conditions which they did not expect at the beginning on some of the projects they came across marshy areas and highly expansive

soil that need to be removed and filled back with better quality material. These materials may have to be hauled from far places. The increase in quantity of rock excavations, which was not originally estimated, as well as increases in the number of minor and major structures, has increased their cost thus putting them at a loss [6].

Some of the major challenges and drawbacks in the previously implemented DB project in the 1990s were [23, 37]

- Lack of the required experience and expertise with the local contractors;
- Client itself was not having the required experience for the DB delivery method;
- Lack of well-established pre-contract planning;
- Local contractors lacked proficient design staff (this is the case with most of the local contractors still) and have limited design knowledge and result in poor quality of design.
- Sometimes the local contractors tendency to 'underbid' the works;
- No clear guidelines for procurement of goods and services;
- Financial incapability and Inadequate equipment of local contractors,
- Poor contract document especially employer's requirement and particular conditions of contract.
- Delayed design approval on the employers representative side.
- Employer's representative lack of confidence to give professional judgment whenever necessary (Lack of timely resolution of issues, Project Management related issue).
- Lack of team work between the contracting parties.
- Problem on entertaining of change and variations.

According to the above challenges, previous Design-Build projects characteristics indicates that there is a gap of understanding the delivery method; stake holders are trying to manage just like as a traditional delivery method, poor understanding of project scope like local contractor's tendency of under bidding without properly analyzing their risks, insufficient skilled man power to manage the project, lack of clear guidelines to use the delivery method and inexperienced local contractors and ERA's professionals are challenged to implement it properly. It needs to be noted that international contractors are benefiting from such strategies.

2.13 Circumstance which DB delivery System is Better Approach

Using Design Build delivery method for all projects is not the right way of delivering. Design-Build project delivery system is better option, and works best under the following condition [43]

- The employer's requirements and expectations are clearly stated, and the proposers are likely to have consistently similar understandings of those needs.
- The single point of responsibility for design and construction is maintained.
- The contract terms make reasonable assignments of risks between owner and design-builder.
- The implementing agency's organization is able to make decisions in a timely manner.
- The project's financing is secure, and that fact is clearly communicated to the proposers.
- The implementing agency's qualification-based selection procedures leading to a reasonable number of proposers in the final proposal stage.
- A working environment of trust and mutual respect can be established among the implementing agency's organization and the design-build team.
- Where early completion and utilization of the facility are of significant value (Gransberg and Molnaar, 2007).
- When the implementing agency's objectives are well-defined, and has well-understood construction aims.
- When the construction is large and technologically complex, and offers the most opportunities for innovation. This maximizes the scope for a designer/contractor team to benefit from matching design and method for the best possible results [44].

According to FIDIC 1999 for EPC/Turnkey condition indicates that using Design-Build Projects delivering is not suitable in the following circumstances:

- If there is insufficient time for tenderers to scrutinize and check the Employer's Requirement, to carry out their designs, risk assessment studies and estimating
- If construction will involve substantial work underground or work in other areas which tenderers cannot inspect.
- If the Employer intends to supervise closely or control the Contractor's work, or to review most of the construction drawings.

- If the amount of each interim payment is to be determined by an official or other intermediary.

Literatures indicate that ERA's have no guide line or has no any other provisions to decide projects to be delivered by DB for projects, but use projects urgency as a major reason. The decision whether to use the DB method of project delivery or any other should be better determined by action of the legislature and discretion of the program, but in local condition there is no federal or organizational legislations regards using Design-Build delivery method. Design-Build program management decides the delivery method. Before deciding the delivery method, requires planning and identifying project complexity, projects needs or offering opportunities for innovation, local market condition of capable contractors to design and construct the projects including minimum project cost for projects to be delivered in DB delivery system. Generally ERA's requirements and expectations are not clearly stated, the Consulting firms are unable to make decisions in a timely manner. Most of the Design-Builders do not fulfil the required qualification, and the projects are not such large and complex, and not require innovation.

2.14 Summary of Literature Review

Starting from ancient industrial revolution period up to now, Design-Build delivery system is implemented widely in the world. The literatures acknowledged the need of DB projects delivery system is for accelerating delivery of design-build projects, improvements in critical areas of the project development process (problems related to design), competitive and transparent procurement processes for selection of the most qualified Design-Build team for the project. It also increases efficiency of their respective highway authorities to improve the development process of Design-Build projects.

Design Build is not the right project delivery system for every project. Each project has a unique set of goals and requirements that should be carefully analyzed and evaluated prior to proceeding with a specific project delivery system. Successful delivery of the projects and achieving expected projects goals depend on selecting a proper projects delivery system that clearly defines contractual responsibilities for design and construction components of the project.

Requirements that should be studied before selecting DB delivery method for high way projects are: -

I. Design-Build Projects

According to the Federal High Way Administration "Design-Build Policy and Procedures (2013)", DB projects may be considered if they fall within the following broad categories:

- Emergency Projects;
- Projects with complex constructability or traffic phasing issues;
- Projects where design and construction need to be expedited for the public good or to capitalize on advanced or specific funding opportunities;
- Projects offering opportunities for innovation; and
- Unusual projects that do not lend themselves to normal DBB procedures."

The type of the project may also be an integral factor in its selection as a DB project. The following types of projects are particularly suitable to the DB process [14].

- New location projects;
- Large interstate widening or rehabilitation projects;
- Projects with heavy traffic volume; and
- Large or unique bridge projects."

According to (Baabak Ashuri 2003, Wubshet J. 2013) Design-Build project delivery system is better option, and works best under the condition that [25, 36].

- The employer's requirements and expectations (project objective) are clearly stated, and the proposers are likely to have consistently similar understandings of those needs.
- Reasonable risks allocation between owner and design-builder (like ROW, utility identification coordination and relocation, environmental analysis and permitting, Design Oversight, Design Acceptance, and Quality Assurance/Quality Control) should be clearly identified and allocated to the right person who can best control it.
- When the implementing agency objectives are well-defined, and has well-understood project objective.
- Decision about basis of proposal evaluation (basis of award) should be clearly set:
- Decision about whether the procurement should be one-phase (RFP process only) or two-phase (RFQ and RFP processes) should be planned early

II. Procurement Mechanism of Design-Build Delivery Method

Generally procurement of Design-Builders is either one-phase (RFP process only) or two-phase (RFQ and RFP processes), the road authority wants to prequalify the contactors and possibly develop a short-list of qualified contractors for bidding.

Most Design-Build regulations require transportation agencies to evaluate price in design-build procurement, particularly where construction is a significant component in the scope of the work. However, in addition to price, non-price factors (i.e., technical considerations) can also be used as the basis of proposal evaluation. There are two approaches for the evaluation of Design-Build proposals as the following: -

- Selection based on price considerations only
- Selection based on price and non-price factors (i.e., technical considerations)

The decision to include non-price factors in the selection of the DB team depends on specific project goals. More specifically, this decision depends on whether the project benefits from evaluating proposers based on price and non-price factors (e.g., aesthetic aspect of the proposed design, concept design, schedule, project management plan, traffic management plan, third-party impacts, quality assurance and quality control plan, and any other relevant factors). The main objective is to select the proposal that brings the highest value (i.e., the greatest benefit) to the road authority on the project. The use of non-price factors in the evaluation of proposals requires establishing proper evaluation criteria to rigorously assess and relatively rank design-build proposals [35].

III. Risk sharing of Stakeholder for Design-Builders

FIDIC conditions of contract for design-Build or Turnkey projects First Edition 1995 have been in widespread use for several decades, and have been recognized - among other things - for their principles of balanced risk sharing between the Employer and the Contractor. These risk sharing principles have been beneficial for both parties, the employer signing a contract at a lower price which no need of preparing the manual and only having further costs when particular unusual risks actually eventuate, and the Contractor avoiding pricing such risks which are not easy to

evaluate. The principles of balanced risk sharing are continued in the new "Construction" and "Plant and Design-Build" Books.

During recent years it has been noticed that much of the construction market requires a form of contract where certainty of final price, and often of completion date, are of extreme importance. Employers on such turnkey projects are willing to pay more - sometimes considerably more - for their project if they can be more certain that the agreed final price will not be exceeded. Among such projects can be found many projects financed by private funds, where the lenders require greater certainty about a project's costs to the employer than is allowed for under the allocation of risks provided for by FIDIC's [45].

For DB projects it is necessary for the Contractor to assume responsibility for a wider range of risks than under the traditional delivery system. To obtain increased certainty of the final price, the Contractor is often asked to cover such risks as the occurrence of poor or unexpected ground conditions, and that what is set out in the requirements prepared by the Employer actually will result in the desired objective.

If the Contractor is to carry such risks, the Employer obviously must give him the time and opportunity to obtain and consider all relevant information before the Contractor is asked to sign on a fixed contract price. The Employer must also realize that asking responsible contractors to price such risks will increase the construction cost and result in some projects not being commercially viable. Even under such contracts the Employer does carry certain risks such as the risks of war, terrorism and the like and the other risks of Force Majeure, and it is always possible, and sometimes advisable, for the parties to discuss other risk sharing arrangements before entering into the Contract [21, 45].

The allocation of risk provided for in the DB Contract negotiated initially between the Sponsors and the Design-Builder may need to be adjusted in order to take into account the final allocation of all risks between the various contracts forming the total package. *(Conditions of Contract for EPC/Turnkey Projects 1995)*

IV. Local Status of Design-Build Delivery System

In the 1970s, large firms began to offer both design and construction services in order to provide project owners with a single source for project delivery. At the beginning, this delivery system was limited to complex projects such as industrial, big plants and big infrastructural constructions

When we look back to the history of road project delivery system which ERA had managed in the past;

- The first one being implemented towards the end of the 1990s [42].
- The second is projects end 2010 [23].
- The third phase begun in 2011.

Major challenges and drawbacks of ERA's previously implemented DB project in the first and second phase were [23, 37]

1. Stake holders was not having the required experience for the DB delivery method;
2. Lack of well-established pre-contract planning; No clear guidelines for procurement; Poor contract document specially employer's requirement and particular conditions of contract.
3. All local contractors lacked proficient design staff and have limited design knowledge and result in poor quality of design.
4. Financial incapability of local contractors, and inadequate equipment;
5. Lack of team work between the contracting parties.
6. Sometimes the local contractors tendency to 'underbid' the works;

In the case of ERA, identifying the road project needs by its Planning and Programming Directorate as per the priority of the roads and the available budget for the projects in which their preliminary designs is prepared by concept designers. It is a new concept that ERA using concept designing for DB projects since 2013. Preliminary design and tender documents are prepared by a design consultant [23].

Ethiopian Road Authority use lump sum contract for DB projects with predetermined project completion date and use FIDIC condition of contract for EPC/Turnkey projects 1995 for risk

allocation among responsible parties. ERA was awarding Design-Build projects for least bidders through post qualification.

2.17 Gap Identification

Objectives of Ethiopian Road Authority (ERA) using Design Build (DB) project delivery mechanism is fast trucking projects, minimizing design change and claim for time extension and cost compensation (Earlier schedule and cost certainty), design and construction risk sharing. According to the desk studies and pertinent literatures in the case of Ethiopian Federal road projects delay, cost overrun, and scope change due to client and /or design builders requests are big problems.

Challenges listed below are major causes which adversely affect ERA's objective of using DB delivery method. Literatures, desk studies (contractual documents and reports) shows there is a problem that stakeholders faced during implementation of DB projects, which having had direct impact on progress of construction works. Major challenges of DB projects can be categorized in to the following major problems

- ERA's insufficient planning and preparation before finding delivery method and poor projects scope definition, contractors required documents are not fulfilled before contract agreement.
- Contractor's incapability and lack of experience on DB delivery method.
- Poor correlation of stakeholders on project objective, and Design-Builders unable to understanding it.
- Lack of on time ROW acquisition.
- Inability of RE's Utilities coordination and relocation to major stakeholders on time.
- Lack of assessing Design oversight, design acceptance (poor control /follow up of employer representative and communication problem among agreed parties)

Even though the DB project delivery method was practiced some thirty years ago, in order to achieve the intended objective requires deep improvement in every aspect of project cycle. Currently ERA is contracted and given out road projects on DB project delivery system to local contractors, and about more than 20 federal road construction projects are under construction.

Challenges of DB projects delivery system is can be categorized that Employer and Employer Representatives should control, Design Builders should control and none of the contracting parties can control.

Generally DB delivery system is theoretically an efficient and effective way of project delivery method, in case of ERA it seems challenging to achieve the intended objective of the organization and projects objective. In addition to desk study, case study and interviewing are conducted to find detail information on current ongoing and completed projects, on implementation of the DB projects delivery method by Ethiopian Road Authority.

3 The Research Design and Methodology

3.1 Introduction

This chapter describes the methodology used to study the implementation mechanism of DB projects delivery method for federal government financed road projects, which designed and built by local contractors. In this section data and information sources, research instruments, sample size and method of analysis are presented. Different section provides a general description of the research approach adopted for this research, as well as justification of the methodology. Each section explains the definitions, decisions, and criteria used for the study.

Identified data sources that contained consistent and accurate projects information for DB projects are the Ethiopian Roads Authority, road construction consultants and different Design Builders are considered in the providing the required data for the analysis of Design-Build projects delivery method. Ethiopian Rods Authority tracks an enormous amount of project information in order to manage DB projects delivery method. In addition to this the originality of the data and realistic representation of the data source helps to end with concrete conclusion and recommendation.

3.2 Study Area Description

ERA is a federal road authority under the Ministry of Transport and Communication for the Development and Management of major highways and link roads (called federal road construction projects) throughout the country. The geographical organization of ERA constitutes five regions (North, South, Central, East and West) which sub divide in to districts. They develop RSDP to expand Ethiopian road network which is divide in to different phases (phase I-V) beginning from 1997 up to 2020. The country's road network has increased from 26,550 km in 1997 to 113,066 km in 2016 (an increase of 326percent), substantial improvement has been registered in the condition of the country's road network. ERA has an ambition of attaining a 222,000 km network in the next three years [2]. This research focuses design-build projects which are administered by ERA and delivered for local contractors which fully financed Ethiopian federal government.

3.3 Research Process

The strategy followed in this research was first started with problem identification which has been done through unstructured literature review, earlier study and informal discussion with colleagues and professionals in the sector; and then the research design was formulated.

Then data and information sources were determined based on the formulated research design. On the basis of the data and information sources the research instruments were decided; and available documentary sources relevant to the research were reviewed. The review includes books, journal and articles, internet sources and archival document search such as progress reports, completion reports, and contract documents within Ethiopian Roads Authority, from DB directorate of the road sector development program in Ethiopia. The document search was mainly intended to collect variables in relation to the implementation of the DB project delivery methods. The document search was mainly intended to collect data related to causes for poor performance of upgrading, rehabilitation and new projects which was completed/ substantially completed and ongoing projects through purposeful selection and focusing on projects with exaggerated time overrun, higher price escalation values for further investigation- to identify important price escalation variables.

Finally, after an in-depth review of literature and desk study, case study and an interview is designed and conducted to contractors (Design-Builders), consultants and the employer (ERA) or employer representatives and opinion of professionals those who involved in DB project operation. Upon obtaining the desired data, checking and sorting of data will be done. Then the data were analyzed for cross-checking the validity and conformity of the information obtained through the overall research work. This is followed by thorough discussions in order to draw a conclusion and to forward recommendations based on the findings of the study.

A descriptive and exploratory investigation design was used in this study. It is attempted to collect data from the relevant population (ERA, consulting firms and Design builders) to evaluate the perception of different stakeholders on the issues of implementation mechanism of DB projects.

3.4 Data Collection

3.4.1 Case Study

In order to obtain answer for the question, like what the gap in local delivering mechanism of DB projects and its effect on project progress, effects on project constructability via original cost, contract duration and scope certainty of projects and Effects on stakeholders. Under what circumstances does DB delivery system better approach for federal road projects, Sampled DB projects, those status are 50% and above completed were chosen.

The approach used to select samples/projects for the case study is cases that serve the real purpose and objectives of the research are selected. Thus DB projects which selected to discover effective implementation of DB projects delivery system.

Figure 3.1 below shows that the flow of case studies that address the following main objectives [46]. Investigating ERA's procurement mechanism of Design-Builders and risks allocation among stakeholders and identifying the gap of implementation and studying its effect on contracting parties.

Developing studying question which the case study answer at the end of study, selecting potential cases from multiple projects that abled to answers studying questions and address the objective. In addition to this designing data collection method for the case study followed and the data collection mechanism which used is interviewing. It is conducted through different referring documents and archival records, conducting individual case study thoroughly, Writing case report which helps to head for conclusion, Compiling each cases and draw case conclusion. Cross check with research question and develop conclusion which is answer for research question, finally writing cross-case report.

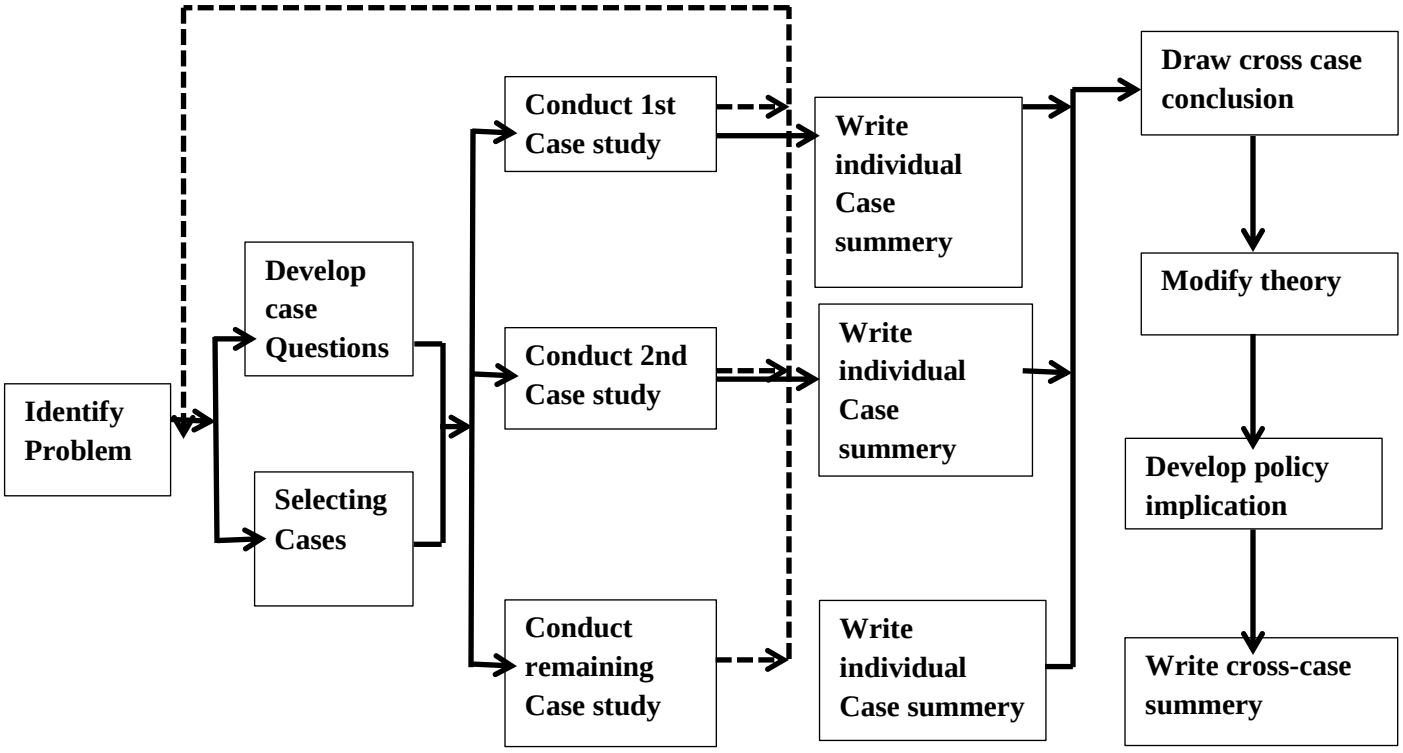

Figure 3. 1 Case Study and Method; Rober K. Yin (2005)

For the purpose of the case study, the following documents were collected:

- Works contract document to take proposed project duration
- Actual completion date or current completed percentage with to date elapsed time
- Problems recorded in the project (or with interviewing the contracting parties)
- Variation order, time extension including any justification with them
- Resolved and pending claim issue, if any
- Site and head office professional organization and availability
- Data related to the list factors under the literature review

3.4.2 Desk Study

Desk study is defined as an investigation of the available facts and figures relevant to a specific issue, often before starting a new or more detailed study [47]. In this research the purpose of the desk study is to supplement case study and interview investigation. Projects selected for case study and relevant questions for interviewing are identified desk study and literature reviewing.

Therefore the desk study is chosen as one of the instruments to assess the practices of DB projects delivery method from relevant studies, reports and documents.

Identifying the causes of poor implementation of the delivery method and its effects on project stack holders and problems encountered during the course of action and the methods to manage/administer it are also in detail investigated and discussed in literature review part (Local Design-Build Projects Delivery Strategy)

Archival documents like procurement methods, selection mechanism, performance managing mechanism, completion report, progress report, and contract documents, specific rule and regulations for DB projects are used as data source for each case. Analyzing that ERA's objective of using DB delivery system is achieved or not (Robert K. Yin (2005)

3.4.3 Interview

The interview is used widely to supplement and extend our knowledge about individual(s) thoughts, feelings and behaviors, meanings, interpretations, etc. about particular research problem and it is one of the best ways to achieve my research objective.

Two categories of interviewing are used to address the intended objective, structured and semi structured. The structured interview is used for exact replication of the interview with others and it is possible to generalize what found out about the population from which the interview sample came. Structured interviews are conducted in various modes: face-to-face, by telephone, videophone and the Internet [46].

To successfully conduct this research it was mandatory to look into the issue from different perspectives and to collect views of professionals who have vast experience in road construction in Ethiopia in general and particularly in DB road projects.

Among the reasons for selection of interviews rather than questionnaire as a data collection tool is that most of respondents not fill the questioner responsibly, some of them forget it at all. But face to face interviewing is quit reliable than questioner. The data is collected and encoded very carefully without changing respondent's perspective.

Informal interviews were used for the case studies parts. The interviews were used to fulfill some missing data. The interviewees were any concerned body available at the organization office by the time of document.

Semi structured is used to increases data reliability, replication possible, ability to ask some spontaneous questions is sensitive to participants need to express themselves, it also provide a more relaxed atmosphere in which to collect information and people may feel more comfortable having a conversation with interviewer and to get much more detailed information than what is available through other data collection methods, such as surveys.

It can be conducted in various modes; face-to-face, by telephone and video phone, but face-to face is used for this research, and in some particular cases telephone call is used.

For confirming findings validity Triangulation from different sources is used: for example, interviewing different members of the population who can give different perspectives on a specific question or topic.

Interview data may provide either quantitative or qualitative data, for this research qualitative data analysis is used in order to analyze the questions.

3.5 Sample Size/Research Population

The study population was drawn from Ethiopian Roads Authority, contractors and consulting offices that have exposure to DB project delivery systems, and professionals.

The samples drawn are the population which selected through purposive selection mechanism. Those who are directly involved on ongoing or completed DB projects are selected. The individuals are also in detail knows project from planning up to current existing conditions.

The research population of the DB projects is those projects which are currently active and drawn from three parties which are participating in federal road construction projects that are: owner Ethiopian Roads Authority (ERA), contractors, and consulting firms. Those professionals include reputed experts engaged in the construction industry and were involved in road construction projects.

The contractors included were General Contractors (GC) or Road Contractors (RC) specially participated DB road project in the federal road construction. The list of contractors and consultants currently involved in DB road construction projects were obtained from Ethiopian Roads Authority (ERA). Currently ERA has more than 10 ongoing DB projects, which are performed more than 50% and handled by local contractors, and 6 consultants are involved in preliminary designing and survey works and seven employer representative firms.

Table 3. 1: Number of participant in interview, academic level and experience on road project

Descriptions	**Experience in Road Projects**				Total
	<5 Years	5-10Years	10-15Years	>15years	
MSc.		8	12	4	
BSc.	5	14	7		
Total	5	22	19	4	50

3.6 Data Analysis

The case study, desk study and an interview are used to find and achieve the intended research objective and analyzed in relation to the theoretical propositions. The method used to analyze the interview data is described below in five major steps.

Formal systems for the analysis of qualitative data have been developed in order to help researchers get at the meaning of their data more easily [48; 49].
These systems involve: -

- Finding and marking the underlying ideas in the data;
- Grouping similar kinds of information together in categories;
- Relating different ideas and themes to one another.

Full texts must be made of all recorded interviews are analyzed through the following steps

Step 1 Organizing the Data

Valid analysis is immensely aided by data displays that are focused enough to permit viewing of a full data set in one location and are systematically arranged to answer the research question at hand [50].

Step 2 Finding and Organizing Ideas and Concepts

Identifying relevant subjects, recurring ideas, and patterns of belief that link objectives and settings together the most intellectually challenging phase of the analysis and one that can integrate the entire endeavor [51]. Finding and organizing ideas and concepts is processed through using

- ***Words/phrases used frequently.*** When looking at the various responses for one particular question, specific words or ideas keep coming up. Make note of the different ideas (i.e., keep a list) as the different responses are read through.
- ***Finding Meaning.*** Learn about a person's perceptions, attitudes, and feelings about something simply by noticing the words they use to express themselves.
- ***Looking for the Unexpected.*** This is where to learn new things or things didn't expect to hear. It is important to always follow up when a participant seems to be going in a new or unexpected direction. These situations are called "rich points" and are often very valuable.
- ***Hearing Stories (Rubin and Rubin)*** Stories are a way for the interviewee to communicate the point of ideas or symbols indirectly. Many events, themes and meanings can come out of a story. It is important to pay close attention to them and to their meanings.
- **Coding and Categorizing Ideas and Concepts.** Once words/phrases used frequently, as well as ideas coming from how the interviewee has expressed him/herself and from the stories that he/she has told is identified, the next step is organizing these ideas into categories.

Step 3: Building Over-Arching Themes in the Data

Each response categories has one or more associated themes that give a deeper meaning to the data. Different categories can be collapsed under one main over-arching theme.

Step 4: Ensuring Reliability and Validity in the Data Analysis and in the Findings

- **Validity:** The accuracy with which a method measures what it is intended to measure and yields data that really represents "reality". Validation does not belong in some separate

stage of the investigation, but instead as an ongoing principle throughout the entire research process.

- **Reliability:** The consistency of the research findings. Ensuring reliability requires diligent efforts and commitment to consistency throughout interviewing, transcribing and analyzing the findings.
- **Validating/Confirming Findings is ensured by using Triangulation:** Findings are more dependable when they can be confirmed from several independent sources. Their validity is enhanced when they are confirmed by more than one "instrument" measuring the same thing.
  - ***Triangulation from different sources:*** for example, interviewing different members of the population who can give different perspectives on a specific question or topic.

Step 5: Finding Possible and Plausible Explanations of the Findings

Making a summary of findings, then ask some questions which evaluate the *findings*

- Are these findings what i were expecting, based on the literature?
- Are there any major surprises in the findings?
- How are they different/similar to what is stated in the literature from other similar studies?

Identifying implications of the findings and organizing the information into a final report

Once over-arching themes are developed, need to think about the implications. Why is the work important, what are the implications within construction industry? The final report includes the results, findings, the implications of those findings and recommendations, how the entire research process was carried out, what went right, what went wrong, highlighting the strengths and limitation how it could be improved and areas of future research that you were able to identify *(Robert K. Yin (2005).*

4 Discussion and Analysis

4.1 Introduction

The previous chapters provide general image of the Design-Build projects delivery method mainly starting from background (development) of the delivery system, international practice, and experience of Ethiopian Road Authority, selection and delivering process of DB projects and general requirements of the delivery system. Furthermore, theoretical background of delivering process has been assessed addressing the potential factors that influence performance of DB projects. Having the insight, an interview is developed to collect data from professionals who have ample experiences on DB road projects in Ethiopia.

The purpose of this section is to screen the factors identified from literature review and the case studies assessment of DB projects delivery process in ERA, also to provide explanations to the issues related to the delivery method and effects of poor implementation on projects contract administration during construction.

The data is collected mainly from four stakeholders who actively involved on the projects, Employer (ERA), Design-Builders, Concept Designers and Employer Representatives, professionals who have past experience on DB projects are also answer some general questions related to specific topic. Here below analysis of the interview data acquired through the responses from professionals who are working for the client, consultants and design builders involved in road construction sector in Ethiopia is discussed in this chapter.

The principal purpose is to identifying further gap of DB delivery system implementation and investigating negative effects of poor implementation of DB projects delivery system. The effects can be assessed through conducting interviewing stake holders and studying on selected cases and professionals who directly involved in DB projects. The variables that mainly addressed the main projects pillars are asked by taking different questions on, delay, cost overruns and scope change of DB projects, and recommendations that shows critical factors that are required to be given due attention.

An interview questions has five sections, but generally it addresses three major parts of investigations, the first part is mainly focused on ERA's Planning, Preparation and Delivering

mechanism of DB Projects, the second part of investigation is focused on Challenges of DB Projects Implementation and the third part is focused on recommendation from their experience to how could correct the gap to overcome the challenges shown in delivery system and make DB deliver method most effective and efficient delivery system. It is important section to hear the solution which comes out from their experience. Contracting parties which actively involved in project implementations are addressed in the interview. Design Builders, ERA (owner), and Employer Representatives have participated. The interview questions are discussed thoroughly not altering interviewee perspective.

Section I

This section consists of inquiries on general background information of the respondents and the organization in which the respondents is representing for.

Section II

This section consists of questions which address location of DB projects (Region-Zone–Woreda) and the main points or town section which the road cross, total road length(Km), contract period (Elapsed time and if not completed percentage of completion) and identifying the nature of projects weather new construction, rehabilitation, upgrading or any other.

Section III

Section three incorporates list of identified possible inquiries which address ERA's DB projects delivering process plan and preparation for each variable contracting parties (ERA, Consultants, Design Builders, and Employers Representatives) questions are prepared that have alike in content but different way of asking.

Generally the question includes ERA's criteria to select projects to be delivered in DB project delivery method and minimum projects criteria to be considered DB project, projects scope defining mechanism, sufficiency of concept designers data to determine overall project scope or beneficial to get comprehensive responses from design builder and Time given for design builders for detail investigation and bid preparation (document preparation), Risk allocation and Risk assessment mechanism for on progress uncertainties, ERA's DB operational system for Design-Builders selection process, Effect of least bidder selection for projects performance,

Local DB bidders' capacity to fulfill employer's requirements like technical, financial, manpower; Milestones or review plane, to revise design during concept designing phase, concept designer's project time estimate is satisfactory for Design Builders and Owner's requirements & contract document not to limit innovation and flexibility are areas of the section.

Section IV

The fourth section mainly answers challenges of contracting parties which caused due to gap of delivery method implementation. The following questions are raised for all interviewed stakeholders. The questions here described in collective manner.

Frame work to control DB projects implementation progress, ERA's as organization provide staff training regarding Design-Build project process management, ERA's standard process to receive, evaluate, and approve ATCs for design-build projects that benefit from innovation, Key Performance Indicators of DB projects which practiced in ERA

Design builder's contract and design activity management mechanism (its effect on contract management system and design management system), Designers delivered the required design on time, ERA professionals offer their continuous comments on design submittals in a timely manner, ERA have a milestones or review plan, to revise design during construction phase, design builders practice to reduce/minimize design errors.

The major challenges of local Design-Builders, Employers Representative, consultants, and Owner (ERA) during construction DB and major causes of delay, cost overrun, scope change, variation and claim investigated. The delivery system enhances or hinders Design Builders ability to perform well in terms of time, cost, and quality and scope certainty, Contractor's capacity to fulfill all requirements on contract agreement is studied in detail.

Section V

This section incorporates questions which are aimed to acquire insights from their recommendation based on the challenges faced during project implementation and administering that will indicate the direction on how to implement DB projects delivery method. In relating to the other countries experience identifying success factors for DB projects and recommending for further correction.

Recommendation for ERA, to consultant, and Employers Representative and design builders to handle the delivery method, the interview is attached as Annex.

4.2 Respondents Background

Part one of the interview is to obtain general information about the involvement of the respondents. It consist of information related to their organization type, their project delivery system (ERA), position in the organization, role in specific project, overall experience on road projects and specific experience on DB projects.

All Design Builders respondents have an experience of above 7 years and above on all road projects experience and above 3 years and above in DB projects. Their position in the project is project managers, site engineers, project coordinates, and High way engineers (Freelancer) and contract engineers.

From Employer Representative's side Resident Engineers team leaders, resident engineers responded the interview. Their experience in consulting road projects is 8-12 years as Resident Engineers. All of them have no previous experience in administering DB projects. Project coordinators, project engineer, senior project engineer, procurement directors and DB projects directorate are respondents of ERA. All concept designers interviewed to get relevant information, on challenges and for remedial measures to be taken on preliminary or concept designing phase. Experience of respondents of concept designers is 6-15 years in consultancy and has more than 3 projects in concept designing for DB projects.

Others which participate interviewing is those which worked in different firms and now working in different responsibility than DB projects, 2 were served in consultancy as employers representative, 1 were as project engineer for design builder and 1were procurement member in ERA

Table 4. 1: Number of respondents from each firm

No.	Firms	Number of respondents
1	ERA	15
2	Consultants	11
3	Design Builders	12
4	Concept designers	6
5	Others	4

4.3 Research Findings and Discussion

Analysis of the data has been made using the above-mentioned qualitative data analyzing method considering the research questions and objective. Organizing the interview questions as follow, each concept is discussed according to respondents view, Design Builders, Employer (ERA) and Employer Representatives

4.3.1 Planning, Preparation and Delivering Process

In this step generally the questions investigates three futures of ERA's DB project delivering process, the first is studying ERA project planning, which includes ERA's road projects need, Planning and Program Directorates of projects prioritizing.

The second is preparation for projects delivering mechanisms. The questions address on investigating the current practice of DB project delivery process in ERA for local Design-Builders and identify the limitation on preparation. The third part investigates selection and delivering process of DB projects under ERA. Some of them are in detail discussed in literature review; here mainly interviewed individual's perspective on the delivery process is discussed, mainly Design-Builders, Employers Representatives and ERA professionals. In some question concept designers view is also included. All respondents forwarded some comments on delivery system, according to the challenges they faced during project administration.

A) Planning and Preparation (Employer (ERA's))

ERA's set criteria for projects to be delivered in DB delivery system, projects urgency and political requirement is the only reason. ERA has does no use any other provisions to decide projects to be delivered by DB or any other delivery methods. The decision whether to use the DB method of project delivery should be determined by an action of the legislature and discretion of the program representative, but in local condition there is no federal or organizational legislations regards using DB delivery method, rather ERA program directorates decide the delivery method. Before deciding the delivery method, requires planning and identifying project complexity, projects needs or offering opportunities for innovation, local market condition of capable contractors to design and construct the projects including minimum project cost for projects to be delivered in DB delivery system.

ERA's preparation for DB projects operation begins by using preliminary design that concept designers prepared. Clear scope defining depends on data collected for specific projects; this requires sufficient time for investigation. ERA set six weeks or eight weeks for all projects concept designing and document preparation. ERA professionals responded that time given for concept designers is not reasonable, did not consider the project scope and challenges to identify access road. Some of them argue that it is enough time to do investigation and concept designer's negligence to begin their work on time; lots of copy from previously prepared documents and also they have no sufficient man power to perform the design and preliminary design. The preparation of a realistic delivery plan for a project is critical for its successful monitoring and implementation of projects, insufficient time to study the site end with incomplete data. Time given for concept designing and investigation for project information should be mainly based on available access to study and project scope, so that the required time also varies.

Based on concept designer's general information, ERA allows contractors to study the sit and prepare bid documents. The bid document includes 5-10% design information, financial proposal and technical requirement. ERA professionals responded that time given to Design-Builders for studying the site, preparation, investigation and bid document preparation is not reasonable time, but currently it is on course of correcting. Some of them debate that it is enough time to do investigation, but Design-Builders are not responsible to take detail investigation on time. They do not begin their work on time, lots of copy and pest and also they have no sufficient man power to perform the preliminary study and they use freelancers. Generally the time given for investigation and document preparation depends on project scope and available access; to have realistic information sufficient time, disciplined and responsible professionals are required.

ERA evaluate technical and financial proposals and select the least bidder. All ERA procurement department professionals and DB directorates respond that selecting least bidder were not factor for deprived project performance; but in capable contractors proposal those who have experience in a single subcontract are the root cause, they brought made-up data, insufficient project information and offer low financial offer to win the bid, this is major challenges in evaluation.

According to ERA respondents selecting least does not affect Design-Builders performance, rather contractor's lack of responsibility affect project performance. Some of the respondents agree that selecting least bidder affects general projects performance, that is why some projects

are get challenged to control it. It is because that contractors poor investigation before bidding. Procurement departments bid evaluation team leaders responded that mostly they had not seen exaggerated change from concept designer's estimation.

Regularly local contractors challenged to fulfill the employer requirements, most of them have lack of experience in specific DB projects, have poor financial management, low turnover and incomplete legal issue; these kinds of problems make selection more difficult.

ERA professionals set scheduled intervals to check the concept designers work with in different interval of time, but most of the time revision takes place after data collected and completed, including tender document and ready for inviting Design-Builders. Its drawback is absence of any fixed time or schedule to respond back. Fixed minimum time given for Design-Builders to implemnt the project is not reasonable.

The contractual agreement for DB projects indicates that full design mandate is contractor's responsibility. Employers Representative revises design standards and comment over it, after correction RE approved in order to heads construction. ERA use risk sharing method which is set on FIDIC (1999) for Turnkey projects includes General Conditions and guidance for the preparation of Particular Conditions, there is no any harmonized risk sharing method for local condition, and also no revised risk assessment mechanism for uncertainties may occur during implementation. A systematic local based approach to risk management can reduce the initial contract price and can help to avoid potential contract disputes. As a result, risk analysis is a crucial part of the DB planning process, and should be one of the first steps taken when the ERA starts to develop the procurement documents. Once risks are identified, ERA will evaluate possible measures to mitigate the potential impact of a risk and will determine how to allocate risks among the contracting parties. In general, risk should be allocated to the party that can best take steps to avoid adverse impacts or to manage the effects of the risk. The contract clauses will be developed to implement the risk mitigation strategies and risk allocation decisions.

According to ERA procurement department and contract administrators selecting least bidder do not affect project performance, or design builders implementation, because Design-Builders have time to assess the risks and overall project requirement; ERA professionals have no convictions on local contractors capacity to fulfill the employer requirements for DB projects, most of them

have luck of experience in specific DB projects, poor financial management (low turnover), incomplete legal issue and poor technical capability are the major problems.

B) Planning and Preparation (Employer Representatives)

In this section Employer ERA's Representatives observation about planning, preparation of and Design-Build projects delivering process. ERA's Representatives of DB projects respond that DB projects scope definition is not clearly defined and it is bad employer's requirement, such as town section limit is not clearly defined, cross sections are indicatives only, only limited parameters are given as base, not fixed what not to do, cut ratio is not clearly defined, technical are not specific to projects, concept design is not completed and most of the problems should be completed on concept design phase.

- ✓ The poor concept design causes poor project scope defined and defining project duration is not reasonable
- ✓ Design-Builder's short duration for detail investigation and document preparation expose for variable work volume than estimated in contract amount. Causes cost overrun, schedule slippage, decrease contractor's efficiency. Lack of harmonization forces contractors to focus on allocation of utilities, strongly involve on environmental and social activities.

ERA's concept designing work to support the environmental documents and analysis, it is part of preparation of DB project delivery mechanism. Preliminary engineering and estimating is desirable to clearly define the projects goals, to better define the scope and project criteria/parameters, and/or to support the assessment and allocation of project risks and minimize contingency costs on the part of ERA and Design-Builder. The engineer's estimate will also serve as the basis for a price analysis prior to award. For certain projects, some supplemental activities may be advisable to facilitate the overall Project Development Schedule. As a general matter it is ERA's goal to perform, define and/or complete projects scope in such a manner so as to allow the Design-Builder to proceed efficiently once the project is awarded. The focus of concept designer's effort should be on identifying and defining issues and problems and defining criteria and parameters applicable to Project work. To maximize the benefits of DB, project solutions should be left to the Design-Builder.

All ERA representatives rely on fairness of DB projects risk allocation that ERA currently applying, but they complain about the time given for Design-Builders in order to investigate detail work volume and identifying major probable risk is not sufficient. Design-Builders are exposed for extra risks which not included in the contract document. Risk allocation requires time to assess risk. Negligence of local contractors to take detail data for bidding causes the delivery system and risk allocation found difficult, all local contractors estimate the project cost per kilometer estimation, which does not consider the actual project characteristics. Some of the contractors have no clear envision for level of risk, employers representatives raise short duration for detail investigation as a reason to contractors risk high and unexpected, causes claim and variation requirement.

C) Planning and Preparation (Design Builder's)

Design-Builders outlook about ERA's planning; preparation and delivering process of DB projects are discussed in this section. ERA as an employer prepared concept designing and defines project scope; all Design-Builders are complaining that ERA's scope definition is not clearly defined. Woreda and Zone authorities complain on Right of Way (ROW) complain on alignments and request for design change, solving such kind of individual's interest is responsibility of ERA, but Design-Builders are engaged on new activity to make agreement on ROW and compensation. Work on a DB Project performed during design phases includes identification of needed ROW and easements, similar to a DBB projects. However, the process for acquisitions is likely different for DB Projects. ERA's employer requirement specifies that identification of ROW is Design-Builders responsibility that the contract documents specify it. It is a risk management best practice for ERA to retain full ownership and control of all actions requiring acquisition of ROW. ERA has an option to assign some or all of the risk associated with the acquisition process to the contractor, it is better that all ROW acquisition is managed by ERA because it escalates project cost and increase contractors activity.

It is researchers opinion that some of the ERA's procedures will likely have to be revised to enable acquisitions to proceed based on the limits identified during design phases or during concept designing, instead of basing the acquisition on the final design. In addition, procedures will need to be founded to allow acquisitions to occur after advertisement and even after Award of the DB contract. If any parcels remain to be acquired following award, the RFP should include

a ROW acquisition schedule indicating dates when access to properties will be provided by ERA. ERA's Project Coordinator for the DB Project should notify property owners when DB projects commence to ensure completion of the ROW identification and acquisition process in accordance with a DB methodology.

Another complaining of Design-Builders is concept designers project duration estimate and time given for project bid document preparation is not reasonable and which does not considered projects work volume, this leads Design-Builders to came up with rough estimation of work volume and unreasonable project cost estimation, due to this claim for time extension and cost compensation occur. Generally ERA fix project duration based on the information and recommendation got from concept designers and usually ERA use common project durations, 30 months or 36 months or 42 months. Design-Builders responded that this duration does not consider project scope, work volume, local contractor's capacity. Project cost is not fixed for contractors, all Design-Builders allowed to come up with their own project cost estimation, but ERA use concept designers cost estimation as a base cost to evaluate tenderers financial proposal.

All contractors respond that ERA's scope definition of DB projects do not participated Woreda and Zone authorities. This cause big difficulty during implementation of DB projects, local authorities try to change the rout alignment. Preliminary work to draft and execute agreements relating to the projects can do much to provide for smoother execution of the project and lessen risk (and emergency costs) to ERA and the Design-Builders. The agreement should include third party agreements like Utility Owners, Railroads, Regulatory agencies, and Landowners. It is important to ERA that carrying out ROW acquisition and utilities relocations (both private and public) if necessary to eliminate delays and can assess delay damages to utilities companies that are not responsive.

Design-Builders respond that selecting the least bidder is not correct way for large scope projects. They mention that selecting least bidder exposes force contractors to offer low project cost (which is not proportional to projects actual cost). Some respondents prefer engineering estimation as selection mechanism is best for local contractors.

All Design-Builders respond that, contract not to limit innovation and design flexibility is just theoretical, ERA directly influence design action directly and force Design-Builders to change design concept. As ERA's DB project management system, owners program is somewhat tight in allowing flexibility and innovation.

Generally ERA's planning and preparation for projects to be delivered in DB Delivery System is not properly prepared, detail studied and not sufficient. Luck of studying projects according its scope, not sufficient precondition preparation for DB projects is major problem.

There is a basic problem in addressing the project scope and commercial arrangements in local contractor's capacity and capability, lack of locally harmonized risk allocation system, lack of early cooperation with regional authorities across the road line by different service stakeholder.

D) Planning and Preparation (Concept Designers)

Concept designing is part of planning and preparation of Design-Build delivering process, so that Consultancy firms that participated in DB projects are participated in this interview to respond remarking ERA's concept design managing method and its challenge. Preliminary study is just a schematic design which forward general information for tenderers document preparation and investigation, it is not a guarantying for contractual agreement (not part of agreement). Concept designers respond that data collected during preliminary designing is not sufficient to determine overall project scope or do not beneficial to get comprehensive responses from tenderers, because base project cost and project duration are determined based on data collected during concept designing. ERA procurement department use the base price for financial proposal evaluation. The bidders also use concept designer's data to study detail information.

Concept designers also share that time given for concept designers and bidders for detail investigation and bid preparation (document preparation) should be based on projects scope and employers requirement. Because of projects urgency ERA gave short period for data collection and detail investigation. But it is not sufficient time for bidders' data collection and risk identification. ERA do not have milestones or review plane, to revise design during concept designing phase, the preliminary design is checked when consultants required for unclear project information. These is not correct way, the mile stones should be set.

Generally ERA has to revise planning, preparation and prioritizing requirements to select projects delivery method. A project must be scoped and a total project estimate must be prepared sufficiently, the scoping of a project should begin with the development and review of the project's goals and risks. The identified goals and risks can then be used to prepare the Project Delivery Selection Matrix and determine the best project delivery method.

Federal government should provide the rules and regulations for DB delivery method usage. The legislation authorizes ERA to enter into DB contracts and to use different procurement process. It also allows the contracting to be used regardless of the minimum or maximum cost, to manage the whole system of the projects. Rule and regulation should include plan and preparation for delivering, Selection Procedures and Award Criteria, Proposal Evaluation Factors and Contract administration method. Use of Design-Build contracting must be based on the individual needs and merits of the projects and qualified projects are defined as projects meeting all procedures and requirements.

4.3.2 Challenges of DB Projects Implementation

In these section challenges of contracting parties during implementation of DB projects is investigated to attain project objective. The questions are mainly addressed the gap in procurement phase which identified from desk study and investigating the effect of the gap on project implementation (challenges to attain schedule certainty, cost certainty, and required projects scope)

A) Contract Administration (Employer (ERA))

ERA uses monthly, quarterly and annual report of project performance from Employers representative (RE) to follow DB projects performance, the report includes the financial, physical and test results, proper mobilization of materials and machine, quality of work, Health and safety records, and amount of rework/quality control.

In ERA project management system, no any specific training how to administer DB projects, but general training about project management system is forwarded when they start the job as a new employee. Co-workers close relationship among the staffs support to comprehend how to administer innovative projects. The Design-Build approach requires a collaborative effort to prepare and produce all of the necessary DB procurement documents. The DB directorates

should provide all of the information and approaches needed to prepare these documents but each project will require some effort to adapt the general DB documents into suitable for a specific DB Project. In general it is expected that ERA will assemble a DB Project Management Team to lead this effort however, this team will need the support (or training) of other management entities in order to complete the procurement documents. The basic DB Procurement and Contract Documents (including the products of the Procurement Strategy Development) and the entity which has the lead role for a preparing or assembling the information that will be included in a particular document as well as the entities which have a supporting or review role in this process. On the contrary it is relevant to Design-Builders and Employer Representatives.

ERA has no in house design team to check design issue, it is recommended by Design-Builders, assisted by consulting firms, which assigned by ERA as Employer Representative for consulting and design approval. ERA has a milestones or review plan, to revise design during construction phase, but professionals not offer continuous comments in a timely manner.

Local contractors are also not come up with alternative technical concept; it is almost alike with concept designer's route selection, main reason is limited capacity of designers. If they come with alternative design concept, it is for the sake of their profit making.

According to ERA respondents major causes of delay in DB projects, ROW problem, Scope change (route change) by request of Woreda and Zone authorities, adverse weather condition, utility management (Ethiopian electric city corporation), and contractors lack of being committed are major problem for poor performance.

Design-Builders poor cash flow management, ROW problem, scope change and price escalation are causes for cost overrun. Due to the nature of contractual agreement (lump sum) ERA is beneficial in this way; there is no significant cost addition.

Woreda and Zone authorities request for scope change, alignment change or control point change, and ROW problem are major causes for variation order of DB projects. There is no significant variation order.

Generally DB projects which handled by local Design-Builders are not in successful progress. According to ERA professional's, the major reason for unsuccessfulness of DB projects are local Design-Builder's low performance, limited potential and Employers Representative incapability on decision making, shortage of material and unforeseen conditions are the major ones.

ERA is advantageous by using the delivery method, due to reduce in staff workload, employers design team requirement is minimized, reduce change orders, improved cost control, design and construction risk are minimized, but;

- ✓ Up to know ERA did not get any time or schedule advantage from DB projects,
- ✓ Some of them incur additional cost compensation to complete the project
    - ♦ Design Builder's lack of innovative design
    - ♦ Poor public service corporations' relations with ERA
    - ♦ Poor scope definition and insufficient planning and preparation for the project.
    - ♦ Design builders do not use the design period appropriately.
    - ♦ Design team does not follow the correct route selection mechanism and detail investigations are not considered.

Contractor is responsible for 3 years waranty period, because of this project quality is attained by using DB delivery system. According to the respondents in some projects quality of road is highly compromised, Employers representatives, contractor's strong will for high profit and weak follow up raised as a reason. In DB projects probability of attaining original cost and required projects quality is high, if early detail investigation is conducted. Local contractors are getting challenged to implement DB projects, if they manage it properly, it can be suitable, but they focus on profit.

B) Contract Administration (Employers Representatives)

Employer's representatives responded that ERA's projects scope definition is not clearly defined and not studied in detail. The major challenges of DB projects implementation are, poor early investigation, lack of harmonization with public across the course of alignment, unclear town section limit, limited design parameters are given as base and cross sections are indicative only, insufficient project duration defined by concept designer, unclear cut ratio defined, technical specifications are not clear and incomplete concept design. Cost overrun, schedule slippage and

scope changes are usual character of local projects. Incomplete information causes decrease in efficiency and effectiveness of contractors and strongly involve them on ROW issue, allocation of utilities and correcting design problems.

Design-Builders are negligent to prepare and provided monthly progress report for employer representative on time. Some of them prepare monthly progress report but not always. Sometimes design builders play with numbers for other tender so that incorrect information is collected unless employer's representative not fully involved.

All employers representative respond that ERA's final design controlling mechanism influence design builder's performance. The design approval has no any specific fixed period, back and forth for design approval takes time. It is good if design review period is short and fixed.

All respondents responded ERA's risk allocation mechanism is fair and according to the principle, but some contractors worrying on risk allocation because they don't understand scope of work, poor investigation of project work volume, do not knowing level of risk, Short duration for detail investigation made contractors risk high and risk allocation requires time to assess risk. According to RE most of the time local contractors estimate the project cost per kilometer estimation, which is do not consider the actual project characteristics. It cause claim and variation requirement.

DB projects has an adversarial relation among contracting parties, mainly Design-Builders insufficient early study before contracting period, employer poor scope definition, ROW problems, lack of cooperation with regional authorities is the major causes of adversarial relation among contracting parties.

Major causes of delays in DB project are contractor poor cash flow management, contractor lack of responsibility, civil war, RE or clients low responsibility on design issue to answer it on time, unclear scope definition, request to increase project length, ROW problems, shortage of power, Late test result, poor contractor professionals decision making, late completion of design and Woreda and Zone authorities force to change the alignment.

According to Employer representatives causes of cost overrun are Scope change, ROW problem and cash flow problem. Major causes of scope change in DB projects is due to Woreda and Zone

authorities request to widen road section at town, alignment and control points change. In some projects both Design-Builder and employer requested for design change. Design changes or scope change is the major cause of claim for time extension and cost compensation, so that DB projects are not time and cost certain projects. Most of the time quality is not compromised because longer warranty period and what on employer requirement is achieved.

Employer Representatives responded that local contractors do not fulfilled all employer requirements on contract agreement. The major challenges of local Design-Builders are poor scope understanding or they don't have clear image of the delivery method, liquid financial problem and lack of sufficient machinery.

The major challenges that Resident Engineers faced when administering DB projects

- Contractors shortage of skilled manpower
- Environmental analysis and permitting (Right of Way acquisition)
- Back and forth for Design approval to ERA
- Utility Relocation
- Scope change

C) Contractor's (Design-Builders)

All local Design-Builders contract managing system is as a general contractor and sublet or outsources design for subcontracting entity; design of DB projects is handled by consultant's sole task and Employer Representative approve it. Design-Builders are getting challenged due to subcontracting designers; they did not deliver design with in the required period. They giving priority for new projects leads to schedule slippage, dispute and disagreement may proceed. Contractors respond that consulting firms (or Employer Representatives) lack of responsibility to deliver project with required time and lots of backs and forth for solving design issue. Approval is also major challenge that Design-Builders suffer employer representative's incapability to make decision, and ERA lack of fixed time for design approval.

All Design-Builders professionals prefer in house design team and they agree that having in house design firm increase Design-Builder's performance; having in house design team is not preferable by local contractors and found it difficult due to

- Lower design cost when compared to construction cost, Design-Builders prefer out sourcing design for consulting firm as subcontract.
- Low probability having DB projects continuously, almost all general contractors have only is a single project on hand or not more than two, so that the design team is idle for long time and design builders overhead cost increases.
- Contractor's capacity to pay design professionals
- Good and experienced professionals are handled by different consulting firms.

It is better to form joint venture, but drawback is profit complains will rise among the two contracting parties, it possible to minimize by forming strong and firm contractual agreement. Another option to having in house design firm is forming sister company.

Currently the only local design builder which has in house design team is Defense Construction. Defense construction in house design team is formed two year ago, it shows good performance, but the team is idle for long time without work.

Another challenge of DB projects implementation is ERA professional's not providing continuous comment over the design according to the milestone in a timely manner and sometimes they do not give comments on draft design, but they request for final design. This leads for contractors to begin construction before design approval of ERA.

DB projects also face delay from the original completion period, the major causes of delay are can be categorized in to different stake holder's responsibility.

- ***Employer and Employers Representatives Responsibility***; Late approval of right of way, scope change (Wored and Zone authorities complaining on rout alignment and right of way), Client late approval of scope change, Sometimes late payment, lack of early utility allocation (Electric poll). Another big problem is ERA's common project duration without considering work volume exposes projects for unexpected amount of delays. During tendering design builders do not take detail data on sub base condition and geotechnical data.
- ***Design Builders Responsibility***; Poor financial management, fear to take risks, lack of decision making, poor subcontractor's selection, limited man power, and lack of good

project manager and poor management system of machineries and materials are the major causes.

- ***Sub-contractors Responsibility;*** designer's lack of responsibility; late design submission, structures are not finished on time, back and forth to solve design issue, prioritizing activities, poor decision making on urgent issues and lack of experience and Earth work sub-contractors negligence to perform on time.
- Causes which are out of control from any contracting parties are unforeseen conditions, civil war and adverse weather condition.

Major causes of scope changes are unclear scope definition by employer, lack of detail investigation during preliminary study, poor of cooperation with Woreda and Zone authorities before designing and weather and natural condition. All design builders are request for standard scope management system.

Design-Builder's major challenges in implementing DB projects are unclear scope defined by owner, (Woreda and Zone authorities) complain on ROW and route alignment, subcontractor's problem to execute their work on time.

- Variation and risk management (risk assessment and risk allocation) for risks occur during implementation method.
- Employer Representatives and ERA late approval of Design-Builders request.

DB projects face a long time of project delay exposed design-builders for cost overrun; due to contract nature design builders have no any chance to claim any cost compensation. Design-builders raise detail data collection and, proper risks identification, and accurate scope management system used are main tool to control it.

According to local Design-Builders response DB delivery system is rarely time and cost certain delivery system. Local contractor's poor scope understanding and lack of detail investigation of project scope causes maximum risk for local contractors.

There is no doubt in the delivery system, but ERA's implementation mechanism and design-builders not understanding the delivery system cause inappropriateness for local contractors. Project duration fixing by using concept designers preliminary study is not correct way, it

requires detail investigation before scope definition, Woreda and Zone authorities should participate in project scope decision, sufficient time is required for project data investigation.

Local contractors define DB delivery system implementation is relatively complex than traditional delivery system. The major thing that make DB delivery system complex is poor scope understanding, unclear scope definition and employer requirement is also challenging and designer's lack of on time design providing.

According to design-builders response DB projects suitability for local contractors and handling DB project is found difficult, the way the delivery system handled and contractors are not well thought about their risks, sometimes ERA by itself try to treat as DBB, contractors are also try to complain as traditional method. Design-Builders are also in bankruptcy, when detail investigation of projects is done before procurement, they become profitable, and risks are identified early. The delivery system requires sufficient staff to study the project scope in detail.

4.3.3 General Recommendation of all Respondents

This section incorporates questions which are aimed to acquire insights from their recommendation based on the challenges faced during project implementation and administering that will indicate the direction on how to implement Design-Build projects delivery method in Ethiopia. In relating to the other countries experience identifying success factors for DB projects and recommending for further correction.

Recommendation for ERA, consultant, and Employers Representative and design builders to cope up with this delivery method, contract administering of the Design-Build project under ERA, ERA's track record in using DB projects from beginning to end.

I. Employers Representatives

- *Employer Representatives* recommendations for *Design-Builders* to cope up with DB projects handling
  - Local design-builders should have responsible and decision making man power which can perform early investigation.
  - Organizing potential in house design team, or form strong cooperation with liable consulting firm and design emphasis should be given for further improvement.

- Before bidding Design-Builders should conduct detail study on characteristics of project like detail scope study, detail risk assessment, completing the design on time.
- Local Design-Builders should correct finance management system and techinical ability of staff.

❖ *Employer Representatives* forward the following recommendation for *ERA* to cope up with this administration of DB delivery system.

- ERA should set clearly defined employers requirement.
- Concept design should be properly conducted, clear project scope study, reasonable project duration estimation and investigation of project work volume
- Estimation should be approximate.
  - ✓ In order to provide sufficient time for projects implementation
  - ✓ To give practical time frame for design builders bid data collection.
  - ✓ Allowing reasonable time for concept designers
  - ✓ To clearly define employer requirement, which consider site condition
- Assigning potential project coordinator at head office.
- Selecting least bidders hide design builders financial management, ERA should correct design builders selection mechanism
- Scope change managemnt system should be set first
- Public requests are not fulfilled (the design and ERA requirements do not entertain public)

❖ Employer Representatives forward the following recommendation for consulting firm to how DB projects should be administered.

- Develop responsibility and professionalism.
- On time responding of design-builders request and approvals.
- Present on site and follow project progress thoroughly

Generally employers representatives define the contract administering of the DB project under ERA are somehow complex.

II. Employer (ERA)

ERA professionals are not confident on capability of local contractors to handle DB projects and forward the following recommendation forwarded for *design-builders*.

- Projects delay, cost overrun and scope change occur due to poor understanding of project scope and individual's risk, poor time management. Local contractors should rise level of investigation and design management system.
- Should build their capacity with sufficient skilled man power (project manager), strong design team, sufficient machinery and plants
- Local contractor of DB projects is highly confronted in terms of financial management, should develop proper cash flow management system.
- Develop being responsible and professionalism, most local contractors focus on escalating profit margin.

Generally local design builders should have in house design team, or should come up with licensed design firm in joint venture during bidding phase. Some design builders hire freelancers handle design responsibility; it is a big challenge that a single high way engineer studies the whole investigation and come up with full documents. Having plenty and capable in house design team will give sufficient service to handle projects as required. Outsourcing design responsibility affects the local design builder's performance negatively.

❖ ***ERA's DB project management system should include or correct the following***

- ERA should develop harmonized relations with third parties before project implementation begin.
- ERA have no any fixed time for design approval, which requested by design builders. Due to this design approval takes time, if ERA has in house design team to comment, design approval to take design responsibility.
- During bid stage, ERA should encourage Design Builders those who come up with in a joint venture.
- ERA should have to follow the projects seriously; ERA's follow up is poor, creating quality team to control the progress
- Sufficient time should be given for concept designers and to contractors according to the scope of project for investigation.

❖ ***ERA respondents forward the following tips for consulting firms***

- ♦ Design firms have lack of being firm and fairness in their responsibility, most consultants are challenged by design builders to change design in lower cost efficient with compromising the quality.
- ♦ Most of the time design builders design is approved by client to change design to the required standard.

III. Design Builders

Contractors are not well thought about their risks, sometimes ERA by itself try to treat as DBB (traditional delivery method) through trying to negotiate on compensation of time overrun, scope change requested by contractors and damages occur due to contractors negligence , contractors are also try to complain as traditional method. Design builder's recommendation on DB project delivery mechanism and way of administration.

❖ ***For Employer (ERA)***;

- ♦ ERA should revise selection of design-build projects. It requires detail investigation and comparison of critical factors that affect the delivery of the project. When reviewing the design and constructability elements, ERA should determines whether a well-defined scope is available or if there are several scenarios that will need to be worked through during the concept design process.
- ♦ Design-build teams are evaluated and selected through what is commonly referred to as a 'two-step' process. This process includes shortlisting that in essence pre-qualified design-build teams on a project specific basis. The short-listed design-build teams then compete for the project on a best value basis that accounts for both cost and a technical score (quality). In the second step is made on a competitive Low Bid basis.
- ♦ ERA should assign potential consulting firm or Employer representatives
- ♦ Head office project coordinators should answer requests, design review and approval on time.
- ♦ It is better if ERA use harmonized or locally revised condition of contract, which consider local market.

- ***For design builders;***
  - In detail investigating project work volume, design and construction risks, financial and manpower capabilities are mandatory during tendering phase of projects.
  - Insuring having sufficient machineries and maintenance workshop
  - Having good design subcontractor determine
  - Developing proper planning and scheduling habit and being committed.

The project delivering plan describes how the project will be executed, what delivery system will be utilized; who and what organizations (including the owner) will perform what tasks and which responsibility shared and contracting will be used. According to the interview analysis ERA's planning and preparation for design-build project delivery system is not sufficient enough to select the appropriate delivery system for the specific project. Preparation for design builder's selection is not to the required level; the time given for concept designers and contractors to collect relevant data for document preparation was not sufficient and does not consider project difficulty to access the site. Concept designers come up with incomplete project information and this leads ERA to incorrect decision on project completion period because ERA fix project duration based on concept designer preliminary engineering work. Poor project scope definition leads to inappropriate decision on base project cost, design builders selection, risk identification and risk allocation.

Generally the level to which the design development should be advanced, it is very dependent upon the specific nature of the project and the associated risk. The owner must provide enough of the preliminary design for the project to ensure that the project scope is sufficiently characterized, to ensure constructability, and to minimize risks for proposers and for the project as whole. Although it may seem logical to advance the entire preliminary design to a set percentage of design (such as 30 percent), such an approach does not respond to the objectives of pre-procurement design development in DB delivery. Each element of the project must be examined to determine how much design needs to be completed to convey the scope while not placing undue risk on the Design-Builder for design. The best request for bidders contain elements with varying levels of design as necessary to define the scope of work and manage the risk. The goal is to convey the project's scope to the proposer with a minimum level of design so

that the proposer may create an innovative design and be fully responsible for any errors and omissions in the end product.

ERA is in a better position to manage ROW risks and to advance Woreda and Zone authoritie's coordination to provide final requirements in the request of the project, doing this helps to control schedule slippages, cost overrun and scope changes. In addition to this ERA should assign responsible representatives who can assist design-builders on site.

To maximize the efficiency and effectiveness of the procurement process, it is important to release as much of the information generated during the concept design development phase of the procurement process as possible through the Reference Documents. But for the most part the more information that is provided to the proposers the better they can develop detailed designs and Proposals that maximize their ability to fulfill ERA's goals for the project and minimize level of risks which occur during constructing. The proposers are not entitled to rely on the Reference Documents and have the responsibility for validating the information, which enables the approach of full disclosure.

Local design-builders should equip themselves according to the projects requirement and project goal, mainly they are poor in cash flow management, lack of sufficient machineries and plants, lack of skilled man power for designing and detail investigation.

4.4 Case Study of the Selected Road Projects

A desk study was conducted, on contractual documents and progress reports of the respective projects found in ERA's archive, to supplement the result from interview survey and to have an overview on the extent of the problem. From the desk study it is revealed that there is a gap of DB projects delivery system, this is most prominent that affect local contractors interest to participate in DB road construction projects under ERA due to different challenges.

All selected DB projects are those handled by local Design-Builders only, administered by ERA and financed by Ethiopian Federal Government, Projects which are in progress above 50% and 11 projects are selected, but for three projects some documents are missed, I found them incomplete for case studies. Eight projects are selected and identifying required information's and discussion is done. The projects have mainly two delivery periods; the 2010/11 and 2013/14 batches. Can be categorized in to two, includes projects those achieving outstanding performance

for their successful accomplishment within the agreed contract cost and time, in this respect two projects are included and projects which have poor achievements.

In the case study the third objective is in detail addressed (investigating the effect of gap occurring during delivering process), problems or challenges of contracting parties in DB project implementation in detail covered. Particularly for projects those exposed for cost and time overrun due to poor implementation and poor performance and in this respect eight DB road projects selected from ERA. Design builders work includes the investigation, survey, design and construction of the road to the respective design standard with the accompanying structures with road furniture and protection works supplemented by a compatible Environmental Mitigation Plan. The selected DB roads projects are listed as follows in their chronological order of construction commencement date:

1. Dolobay - Dolo Ado, contract II Design and Build Road Project Contract
2. Dejen - Felegebirhan
3. Debark - Buahit - Dilyibza Design and Build Road Project
   Lot I: Debark – Buahit
4. Debark_Buahit _Dilyibiza Design and Build Road Project
   LOT II :Buahit _Dilyibiza
5. Laska – Salayish DB project
6. F2-F1-Hana
7. Tekeze River–AbiAdi Design Build Project
8. Demitu- Moricho- Bitena Project

From the above list Tekeze River–Abi Adi Design Build projects is recorded as a good project progress.

4.4.1 Hargele - Dolobay - Dolo Ado DB Road Project Contract

Hargele - Dolobay - Dolo Ado, Design and Build Road projects is located in Somalia region which handled by two local contracts I (*Hargale – Dolobay) by* Enyi General Constructor and contract II (*Dolobay-Dolo Ado*) design build project constructed by MACRO construction plc. The road starts at a station of 000+000 from Dolobay and terminates at 81.1km at Dolo Odo.

Here *Dolobay-Dolo Ado* project is selected as case.

Table 4. 2 Project information of Dolobay-Dolo Odo contract II

Construction Type	**Upgrading to DS4 Asphalt Concrete Surfaced**
Type of Contract	Lump Sum (Design and Build)
Financier	The Government of the FDRE
Employer's name	Ethiopian Roads Authority
Contractor's name	MACRO Construction PLC
Employer's Representative name	Transport Construction Design Share Company(TCDSCO)
Letter of Acceptance Given	30 July 2010
Date of Contract Signature	03August 2010
Commencement Date	06 September 2010
Contract Duration	1095 Calendar Days
Actual completion Date	September 06 2013
EoT recommended by Employer representative	450 EOT
EoT Approved by the Employer	450 EOT
Original Completion date(revised completion)	September 06/ 2013
Defects Notification period	365 Calendar Days
Original Contract Price (including 15 % VAT)	ETB 405,726,000.00 (including VAT)
Value of Claims approved to-date	-
Total Price Adjustment to-date(without VAT)	-
Interest paid on Late Payment to-date	-
Estimated/Revised current Contract Sum	-
Percent Payable in local Currency	100% ETB
Project Length: Est. Original Actual	86km 81.079 km
Mobilization Period	3 months
Elapsed time to-date	completed

The Contractor has completed the project 100%. However EoT indicates 450cal day, until the end of project completion the slippage with respect to time is 560 calendar days. It shows 51.2% slippage of original contract duration. The trend of ERA approval for EoT for DBB projects is

highly below than Employers Representatives, in Hargele - Dolobay - Dolo Ado DB project indicates employer approval is equal with Employer Representatives approval.

Major causes of for unsatisfactory, that having had direct impact on progress of construction works of Dolobay-Dolo Odo DB project is unable to complete the project according to the schedule and with initial contract amount due to contractor inability to fulfill the contract requirements (poor understanding the project scope), absence of detail investigation for tendering (miss judgment of Genale River Bridge), Poor coordination among the contractor's office and site staff unavailability of proper work schedule (plan), and sub-contractors (design firm) inability to provide design on time, poor financial management, poor material management are major causes for unsatisfactory progress. Design builder has shortage of potential manpower to coordinate and manage the project. The above design builder DB project challenge shows in capability of contractors to handle both design and building responsibility.

ERA's fixed project duration is also another effect for delay, the project delayed for 560 calendar days; this indicates ERA's estimation of project duration is not reasonable (not considering project work volume). Miss judgment on structural element and poor scope study affect design builder finance management, the contractor complete the project without profit. Design firms professionals are juniors, and challenged to provide design on time and poor decision making affect project progress of the project.

It is researcher's opinion that ERA planning and preparation for DB project delivering is insufficient. EAR's scope definition is not sufficient enough so that bidder's evaluation and selection requirements are not to the level of the project scope. Selecting unqualified Design-Builder exposes ERA for exaggerated time extension. Selecting best value bidder by allowing factors other than price to be considered allows ERA to select qualified Design-Builder that best meets a combination of projects goal and stakeholder goals. Furthermore, price itself should be evaluated not only on the cash amount but also on factors such as responsiveness and reasonableness of the price proposal.

Generally Dolobay-Dolo Odo project is not schedule and cost certain project. ERA prefer letting the contractor to complete the project rather than terminating the contract. However the project delayed, due to the nature of contractor ERA is advantageous, request for cost compensation and change order or claim for variation is reduced. Employer Representative Report and ERA final

report approve that the project quality to the standard of the employers requirement on contractual agreement. According to, Dolobay- Dolo Odo project manager MACRO Construction PLC completed the project without any profit. Now the project completes the defect liability and warranty period and fully handover to ERA. Design builder's lack of capacity for innovation and good management system like cash flow problem and experience, lack of skilled and risk taker professional staffs is also the major factor for delay.

4.4.2 Dejen - Felegebirhan DB Road Project Contract

The project is located in North West part of the country and begins at about 233 km from the Addis Ababa and 8.5 km from Dejen Town towards Debremarkos at a place called Tik in Amahara region. It connects the small towns and villages such as Tik, Yetmen, Bichena, Debrework and ends at outskirt of Felegebirhan town. General project contract information is in table below.

Table 4. 3: Project information of Dejen - Felegebirhan

Construction Type	Upgrading to DS4 Asphalt Concrete Surfaced
Type of Contract	Lump Sum (Design and Build)
Financier	The Government of the FDRE
Employer's name	Ethiopian Roads Authority
Contractor's name	SATCON Construction PLC
Employer's Representative name	Net Consult Consulting Engineers & Architects Plc.
Letter of Acceptance Given	21st June 2011 and received on same date
Date of Contract Signature	27th June 2011
Commencement Date	03rd August 2011
Contract Duration	1279Cal. days (Excluding defect liability period)
EoT recommended by Employer representative	Till 03 Nov 2016
EoT Approved by the Employer	Till 03 Nov 2016
Original Completion date	02nd February 2015
Defects Notification period	365 Calendar Days
Original Contract Price (including 15 % VAT)	ETB 528,000,000.00
Value of Variation Order to-date	17,150,902.7(without vat)

Value of Claims approved to-date	-
Total Price Adjustment to-date(without VAT)	ETB 123,302,568.06
Interest paid on Late Payment to-date	-
Estimated/Revised current Contract Sum	ETB 528,000,000.000
Percent Payable in local Currency	100% ETB
Percent Payable in Foreign Currency	-
Project Length: Est. Original Actual	77.6 km 75.2704km
Mobilization Period	3 months
Elapsed time to-date	2032 cal. Days (158.87%) until 28 Feb.2017

In Dejen-Felegbrihan DB project, the contractor had given four variation orders, except Felegbirhan town section work which is not yet summited by the contractor and as Extension of Time [EoT] status report shows the Employer Representative has given 800 working days and ERA approved, the revised completion date of the project is till 03 February 2017. But the project is not completed with this time extension. The claim status and development record shows that the contractor has submitted the second, third, fourth and fifth claim to the employer. ERA did not conduct preliminary study in detail, so that projects duration increase beyond original contract. So that ERA forced to approve all consultants' approval.

Major causes of for unsatisfactory progress that having had direct impact on project progress are due to stakeholders negligence:-

- **Employer (ERA's): -** Late commencement of permanent activities which has started nearly after four months [as of 19th Nov. 2011] from the commencement date and also unsatisfactory progress thereafter. Poor detail investigation, scope definition, unreasonable project duration set bay EAR.
- **Contractor's**:- lack of sufficient resources for the construction like; machineries, skilled manpower and production plants.
    - Delay to erect efficient crusher which significantly affects production of sub-base, road base and asphalt aggregates.

- Week management system; Cash flow management problem of the contractor, like workers strike (due to salary dalliance) wage payments was delayed more than two-three months, supplies are not to the required level, frequent break downs of asphalt plant and base course & asphalt aggregate crushes are not maintained for several weeks, though the Contractor has collected 100% of the advance payment and also interim payment certificates so far the above problems were not solved. It was the core cause of the contractor for not executing the project work for the satisfaction of the employer.
- Inefficient project management which is reflected in failure to produce work program even after comments and reminder from the Employer's Representative, not making timely request of land acquisition along the project road for material sources, delay to produce materials with mobilized equipment, and
- Weak Contractor's head office support to the project in procurement of equipment [road construction equipment's, crusher, formworks, etc.] and manpower like senior surveyor and construction engineer, supplies [cement, CIS, fuel, camp construction materials, etc.], communication [radio, fax, internet, etc], and failure to urge and follow up the project management to execute project works.
- Poor work methodology for drilling and blasting during the executions of rock excavation

Employer is responsible for on time commencement of projects, and Employer Representatives is responsible for on time approval of design issue, unable to facilitate and respond the right of way problem, utility allocation and scope change managing.

The project shows above two years delay and 3% variation order. However percentage of variation is small, but design builder representatives respond that the contractor is in bankruptcy. The main reason raised newness of the delivery system and, poor early investigation before tendering and not properly identifying design and construction risks , sub-contractors negligence (designers) management method.

In Dejen-Felegbrihan project Design-Builder's lack of capacity for innovation and good management system like cash flow problem, labor management, and shortage and machinery management problem, late mobilization of materials. Lack of skilled and risk taker project

manager and senior professional staffs. In addition to the above challenge lack of in house design staff take big share for the delay the project.

Due to the above reason the contractor faced difficulty to construct according to the contract; from the above table we can understand that there are claims for time extension and cost compensation. Maximum project delay is just like traditional delivery method.

It is the opinion of the researcher that if risks were identified before the start of the project and interference measures were implemented during front end planning process by allowing the project scope definition to pass through project definition matrix. The extent that the original contract time setting is may not be properly investigated. Having responsible Employers Representative is also mandatory for project success.

For Dejen-Felegebrihan project progress indicates that the design-builder weakness is shown clearly, ERA's design builders selection mechanism need to be revised that selecting potential design builders, have proper management system reduce extra time and cost overrun. Design-Builder that has proper cash flow management, labor, plant and material management system and who can on time mobilize of construction materials is possibly reduce such exaggerated project time overrun. In addition to this finding responsible design sub-contract reduce the uncertainties. ERA should revise its scope defining mechanism and design builders selection mechanism. Design-Builder incurred extra cost to complete the project, not getting service on time, ERA spent a lot of cash for consultancy and end users suffer in access road are major effect in this project.

4.4.3 Debark - Buahit – Dilyibza, DB Road Project Contract

Lot I: Debark – Buahit

The objective of these two projects is for political reason and to connect Debark town with Buahit and Dilyibza town and to make access road for mining projects located in Afar region.

In this project claim requested for change in control point from Debark–Park Gate– Belegez River–Enchetkab–Denkoloko–Buahit to Debark–Park Gate–Belegez River–Mekanne Birhan–Denkoloko–Buahit is requested. As a matter of excessive variation part of the route was cancelled and being ready for a competitive bidding. Accordingly now the route can be called as

Debark Beles (km27+000) and Buahit- Mekane Brehan (34.8 km) and constructed by AKIR Construction PLC. Beles-Buahit (30km) is awarded to Defence Construction Company.

Table 4. 4 Project information of Lot I: Debark-Buhait

Construction Type	Double Surface Treatment (DBST), DS5.
Type of Contract	Lump Sum Contract (Design and Build)
Financier	The Government of the Federal Democratic Republic of Ethiopia
Employer's name	Ethiopian Roads Authority
Contractor's name	AKIR Construction P.L.C. (Ethiopia)
Employer's Representative name	Construction Design Share Company (CDSCo)
Letter of Acceptance Given	March 10, 2011
Date of Contract Signature	March 29th , 2011
Commencement Date	July 4th, 2011
Contract Duration	1096 Cal. Days
EoT recommended by Employer Representative	951 Calendar days
EoT Approved by the Employer	951 Calendar days
Original Completion date Revised completion date	July 3rd, 2014 March 29, 2017 (2095 Cal. Days)
Defects liability period	365 Calendar Days
Original Contract Price (including 15 % VAT)	ETB 699,465,650.00
Value of Variation Order to-date	-
Value of Claims approved to-date	-
Total Price Adjustment to-date(without VAT)	-
Sum Revised contract price (including 15 % VAT)	ETB 652,773,497.55
Percent Payable in local Currency	100% ETB
Project Length: Est. Original Revised length	65.0km 61.8 km
Mobilization Period	4 Months
Elapsed time to-date	200%

Following the contractor claim for determination of cost and time, the project completion date is extended to 8thFebruary 2017 and its final project cost is ETB 652,773,497.55. The contractor, however appeal for the revision of the project price administratively. The project information shows that 100% project schedule slippage, the project is not completed until May 2017. The major causes for unsatisfactory progress that having had direct impact on project progress are negligence of different stakeholders;

- **Employer (ERA): -** Poor project scope definition, project length is increased from 65km to 91km and Employers representatives not responding design approval issue on time.
- **Design-Builder:** -The Contractor insufficient resources (manpower, material and equipment) and lack of proper applicable work program to take action to compensate lost time, lack of giving attention and action with regard to traffic management and quality of diversion construction. The diversion in both Debark and Buahit, unwillingness to close follow up and maintenance with immediate effect and absence of design professional team on site to support the contractor.
  - The Contractor is required to present request for lands acquisition at least three months in advance of his requirement for such lands, negligent on access acquisition.
  - Lagging of the main activities like construction of major drainage structures and producing base course with immediate effect.
- **Civil War: -** is also another cause for projects poor performance.

Generally Debark-Buhit Lot I project is recorded unsatisfactory progress, with time extension of 100.4% due to contractor failure to provide the required manpower, equipment and materials, at the right times and in the right quantity, resulting from cash flow problem. Frequently breaking down of equipment and lack of immediate maintenance, lack of proper work schedule, not understanding scope of the project and design team not providing required design on time, unfavorable weather are the main challenges.

It is the opinion of the researcher that clearly defined project scope and identifying contracting party's risks before the start of the project is mandatory for better accomplishment. Local Design-Builder selection mechanism requires change, best value and qualified contractor selection is may minimize such exaggerated project delay. The extent of change indicates that the original contract time setting is not properly investigated. Acquiring responsible design

professional team on site to support contractor activity is obligatory to reduce time extension. ERA should revise Design-Builders selection mechanism and scope defining mechanism. Design-Builders extra cost incurred to complete the project, ERA spent a lot of many for consultancy and end users suffer in access road are major effect in this project.

4.4.4 Debark-Buahit -Dilyibiza : - LOT II :Buahit-Dilyibiza DB Project

The objective of these upgrading projects is to make access road for mining projects located in afar region.

Table 4. 5 Lot II: Buhit-Dilyibiza project information

Construction Type	Upgrading to DS4 Asphalt Concrete Surfaced
Type of Contract	Lump Sum (Design and Build)
Financier	The Government of the FDRE
Employer's name	Ethiopian Roads Authority
Contractor's name	SATCON Construction PLC
Employer's Representative name	Transport Construction Design SCo.
Letter of Acceptance Given	March 28,2011
Date of Contract Signature	March 29, 2011
Commencement Date	April 25,2011
Contract Duration	1096 Calendar Days
EoT Approved by the Employer and ERA Representative's	405+557 Calendar days
Original Completion date(revised completion)	December 12, 2016
Defects Notification period	365 Calendar Days
Original Contract Price (including 15 % VAT)	ETB 947,920,000.00 (including VAT)
Value of Claims approved to-date	-
Total Price Adjustment to-date(without VAT)	-
Estimated/Revised current Contract Sum	-
Percent Payable in local Currency	100% ETB
Project Length: Est. Original Actual	Assumed 57.8 km / 72.8 km as per the design surveying
Mobilization Period	3 months

Elapsed time to-date	Almost completed

The project shows time overrun due to increased project length as per the design survey. The change is 15km. 405 cal. days are added for length change, but the project requires additional 557 cal. days to complete the project 38% increase in project time over original completion period. The major causes for unsatisfactory progress, that having had direct impact on progress of project are can be categorized among different stakeholders responsibility.

i) Design-Builder negligence;

- Design firm negligence to provide design on time cause considerably delayed to complete the design document of the project and late submission of working drawing for review/comment.
- Unavailability or acute shortage of materials and insufficient equipment and machinery, and lack of timely maintenance and replacement for broken equipment's and machineries, due to acute shortage spare parts and unavailability of capable maintenance workshop crew.
- Shortage of skilled manpower, and delayed assignment in replacement of project manager. Head office and site staff's poor communication, with the Engineer and Employer cause very slow rate of progress
- Unavailability of revised works program and other advance planning for works by the project management. Inability to substantiate his time extension claim with sufficient contemporary records. Delayed request for ROW clearance and works particularly in the Seimen mountain national park.

ii) Employer poor scope definition, which 15km project length increase is beyond contract agreement, unexpected risk for design builder.

iii) Employer representative lack of responsibility; causes interruption by the habitants across the rout due late accessing ROW.

iv) Unforeseen Natural weather condition; Rainfall caused disruption to works and blockage of drainage structure due to silt transported with the flood and rain caused access problem.

It is the opinion of researcher that clear scope definition, selecting potential design builder and assigning responsible employer representative reduces such exaggerated time extension of

project. The project contractual agreement is lump sum and it does not allow claim for cost compensation, the contractor is forced to construct it by own cost. ERA should conduct detail early project study and award the project to potential contractors.

As shown above challenges of implementing Buhite-Dilyibza DB project is contractor's incapability in terms of manpower, financial and technically. Selecting the right design builder is encouraging and helps to reduce negative effect on contracting parties. ERA should take responsibility to set Woreda and Zone authorities request for alignment changes before construction begin, which are major causes for delay the project, so that Employer Representatives request for extension is approved. ERA should revise Design-Builders selection mechanism and scope defining mechanism.

According to SATCON construction head, the Design-Builder is in bankruptcy and incurred extra cost (5% of original contract amount) to complete the project, ERA spent a lot of many for consultancy and end users suffer in absence of access road are major effect in this project.

4.4.5 Laska – Salayish DB Road Project Contract

General information of Laska Salayish project, which is located SNNP region, intended to connect the two Zone authorities (Gamo gofa-Benchi Maji) with upgrading DS5 asphalt road project.

In Laska Salayish project there is no variation order issued to-date initiated by any of the parties in the contract, Extension of Time [EoT] status and development shows 1096 extension of time is allowed to complete the project, is 100% extension. Claim status and development indicates**;** there is claim for extension of time claim arise so far from design builder due to the above challenges in the project. However, the contractor had submitted his intent of claim No 1 regarding to the landslide encountered at station72+960-73+040 and the Design-Builder got approval of ERA for the claim.

The project also slip on permanent works is which the slippage shows that the project going behind the schedule. Cost compensation is done for project scope change, and also price adjustment is done.

Table 4. 6 Project information of Laska-Salayish DB project

Construction Type	**Upgrading to DS5 Asphalt Concrete Surfaced**
Type of Contract	Lump Sum (Design and Build)
Financier	The Government of the FDRE
Employer's name	Ethiopian Roads Authority
Contractor's name	SATCON Construction PLC
Employer's Representative name	TOWERS Consulting Engineers and Architects PLC.
Letter of Acceptance Given	21st June 2011 and received on same date
Date of Contract Signature	27th June 2011
Commencement Date	August 05, 2011
Contract Duration	1096 Cal. days from July 8th 2011, effective date.
Original Completion Date	August 04, 2014
Revised Completion Date	March 18. 2015
EoT recommended by the Engineer	Till 03 Mar2017
EoT Approved by the Employer	Till 03 Mar 2017
Expire Date	August 05, 2015
Defects Notification period	365 Calendar Days
Original Contract Price (including 15 % VAT)	ETB 689,885,000.00 (Inclusive of VAT)
Value of Variation Order to-date	-
Value of Claims approved to-date	-
Total Price Adjustment to-date(without VAT)	81,737,877.12 ETB
Percent Payable in local Currency	100% ETB
Project Length: Est. Original (Actual)	64.4 km (approximately)
Mobilization Period	3 months
Elapsed time to-date	1996 cal. Days (182.12%)
To-date project completion	57.96km (90%) in Mar 2017

The Major problems encountered in Laska Salayish project is illustrated here under are among the many, categorized in to project stake holder's responsibility.

i. **Design builder responsibility;**
   - **Managing design firm activity;** design firm lack of on time investigation and causes landslide in different location, late commencement of Structural (bridge) and overall project design.
   - **Revising work schedule;** it is major challenge in Laska Salayish project.
   - **Insufficient skilled man power on project;** the contractor has no material Engineer for a long time and Project Manager, Office Engineers, experienced superintendent of material production and structure foreman are not deployed in replacement of previous employee for long time.
   - **Equipment management;** Shortage of major construction equipment, like Crusher, dump truck and water truck and equipment for asphalt work are not mobilized on time, and Delay of supply of Spare parts for breakdowns equipment
   - **Supplying Construction material on time;** Shortage of construction material supply, like reinforcement bar are not mobilized or delivered to the site for slab and major structures, Bitumen for prime coat and surface treatment not positioned on time, and sand and masonry are not produced and stocked sufficiently
   - **Cash flow management;** Poor cash flow management causes workers to stop working due to contractor unable to pay their wage on time, design builder use the advance payment for another project.

ii. **ERA is responsible to clear Right of Way problem;** Electric pole (both wooden and concrete) electric line and transformers are not removed in all town sections.
   - Delay occurs due to ERA lack of cooperation with social service working corporations. Delay of removal of electric poles From54+600-56+600 and 65+500 ahead specially concrete poles. Repeatedly removal of electric poles had been requested and compensation paid to EELPCo but the response from the EELPco Sawla district is slow, the Employer is requested to discuss the matter at the higher level.

Generally challenges of implementing Laska-Salayish project is mainly from two parties, employer (ERA) poor project scope definition and lack of contractual cooperation with third party force Design-Builders change project scope and waste most of its time on it, poor project time estimation, not assigning potential representative are some of the challenges. The second is Design-Builder's incapability to fulfill employer's requirement and inability to perform

according to the contractual agreement. This cause Design-Builders fall in bankruptcy and extra cost incurred to complete the project, ERA spent a lot of many for consultancy and end users suffer in absence of access road are major effect in this project.

Generally projects which delivered in 2010/11 have lack of detail investigation before tendering, ERA do not conducted sufficient study to define project scope so that project duration set without considering project scope, local market, local contractors capacity and capability to handle the projects.

4.4.6 F2-F1-Hana, DB Road Project Contract

Investments like Sugar factory Plantations and similar development projects are being established along the vicinity of the Omo River which is located in SNNP Regional State. The construction of Factory 2 (F2) to Salayish Junction through Factory 1 (F1) is intended to provide access for the construction of projects from Factory 2 and Factory 1 to the road network of the country.

The overall length of the road project is expected to be 37km from Factory 2 to Salayish Junction which involves construction of a new road to DS4 Geometric Design Standard.

F2 ~ F1 ~ Hana Road Project is a project that includes the Design & construction of a Double Surface Treatment, DS4 in ERA standard.

Claim for extension of time status and development indicate that the Design Builder has requested 267 working days' time extension due to, delay in release of advance payment, delay in approval of route selection (Delay in assignment of Engineer's Representative) and 267 days extension of time approved by ERA. The project 49% time overrun over the original contract duration.

Major causes of for time overrun, that having had direct impact on project progress are design builder's responsibility;

- Break down of Machineries and shortage of equipment's spare parts
- Contractor's poor understanding of the project scope.

Table 4. 7 Project information of F2 ~ F1 ~ Hana DB projects

Contract Title	**F2 ~ F1 ~ Hana Design and Construction Road Project**
Type of Contract	Lump Sum (Design and Build)
Financier	The Government of the FDRE
Employer's name	Ethiopian Roads Authority
Contractor's name	ENYI General Business Plc, ENYI Construction
Employer's Representative	SABA Engineer's PLC.(Uganda)
Date of Contract Signature	02/10/2013
Date of Commencement	14/11/2013
Type of Contract	Design & Build Project (DB)
Original Contract Price	ETB 651,111,223.66
Value of Variations	Nil
Revised Contract Price	Nil
Contract Period(Total)	730 Cal. Days
Mobilization period	4 Months
Construction period	610 Cal. Days
Value of Approved Claims	Nil
Contract Period(Original)	730 Cal. Days
Contract Period(Revised)	1021 Cal. Days
Currencies and Proportion of Payment	ETB -100%
Minimum Value of Interim Payment Certificate	Birr 2,000,000.00 (Two million Birr)
Recovery of Advance	After Certification of 30% of the contract price.
Original Completion Date	14.11.2015
Extension of Time	267 cal. Days
Revised Completion Date	28/09/2016
Defects Liability Period	1095 calendar days

F2-F1-Hana project is got challenged to complete with contract duration due to Employer representatives negligence to on time approval of rout selection, Delay in approval of Geometric

Design and Employer delay to assign consultant and delay to pay advance payment are the major ones. Gibe River takes a long time beyond expectation.

Lack of responsible person at ERA head office who respond design builders request for approval and design builder lack sufficient machinery, designers not providing structural design on time, lack of detail investigation during studying for bid submission, unforeseen conditions seriously affect project time performance and project cost. However it shows less schedule slippage, when compared with other DB projects.

4.4.7 Tekeze River–Abi Adi, DB Road Project Contract

The project road is located in the Northern part of Tigray regional State.

Table 4. 8 project information of Tekeze River-Abi Adi DB project

Contract Title	Contract 2: Tekeze River–Abi Adi
Funding Agency	Government of Ethiopia
Employer	Ethiopian Roads Authority
Contractor	SUR Construction Plc.
Employer's Representative	Towers Consult Plc.
Signing the Contract/ Contractor	May 22nd, 2014
Date of Commencement	June 24, 2014
Original Time for completion of works	June 23, 2017-1095 Cal Days
Extension of Time to date	None
Type of Contract	Lump Sum Contract/Design and Build Contract
Project estimated length	52.67 Km
Revised Project length	46.283 Km
Original Contract Price (including Vat)	ETB 2,146,302,500.00
Value of Variation Orders to date	-
Value of Claims approved to date	-
Total Price Adjustment to date	133,188,229.86
Percent Payable in local currency	100 %
Time for Submission of Work Program	Within 30 days after Commencement date

Overall accomplishment to the end of February, 2017 was 94.2% against plan of 92.9%. Contractor's work progress shows that ahead the schedule. During studying the case studies the project is 99% completed with time elapsed 98%.

- **Variation Order;** There is no any approved variation to end of January, 2017
- **Claims Status and Development;** No claim notice had been issued by the contractor up to date
- **EOT Status and Development;** No EOT claim had been developed yet.

Tekeze River–AbiAdi Design Build Project is a project that completed according to the schedule, with original contract amount. There is no any variation order due to scope change, no claim for time extension and cost compensation.

Employer representatives respond that the reason for successfulness of the project mainly depends on design builder's performance, SURI construction has sufficient amount of machineries, adequate allocation of plants on site, on time mobilization takes, and good management practice in financial and manpower.

Design builder's SURI construction project coordinator responded that, the company uses its utmost potential to complete the project. ERA project scope definition is not clear and not fully defined; a lot of alignment changes across the route, but SURI construction takes its own responsibility to make decision.

4.4.8 Demitu- Moricho- Bitena DB Road Project Contract

Demitu-Moricho-Bitena project lot 2 Moricho-Bitena project is one of the latest DB project which administered by ERA, the objective of the project to connect two Zones in SNNP, Sidamo Zone and Wolita Zone. General project contract information is in table below.

The Contractor's to date accomplishment = 79.45% /or 48.30 km compared to date Plan = 92.63% /or 56.32 km and slippage with respect to time = 13.32%, Slippage with respect to plan= 13.18% /or 8.01 km.

Table 4. 9: Project information of lot II Moricho-Bitena project

Construction Type	**New construction DS3 Asphalt Concrete Surfaced**
Type of Contract	Lump Sum (Design and Build)
Financier	The Government of the FDRE
Employer's name	Ethiopian Roads Authority
Contractor's name	Sunshine Construction Plc (Ethiopia)
Employer's Representative name	Civil Works Consulting
Letter of Acceptance Given	24-September-2014
Date of Contract Signature	03-October-2014
Commencement Date	05-December-2014
Contract Duration	931 Cal. days (Excluding defect liability period)
EoT recommended by the Engineer	-
EoT Approved by the Employer	-
Original Completion date	06-June-2017
Defects Notification period	365 Calendar Days
Original Contract Price (including 15 % VAT)	ETB 995,000,000.00
Value of Variation Order to-date	-
Value of Claims approved to-date	-
Estimated/Revised current Contract Sum	-
Percent Payable in local Currency	100% ETB
Project Length: Est. Original	60.1Km
Mobilization Period	3 Months
Elapsed time to-date	80.2 % (847 Calendar days)

Claims Status and Development indicates that the contractor has notified to claim on allocation of resources for the Bilate River Bailey bridge erection. The Contractor has claimed on unfavorable weather Condition out of the months of April and May 2016, due to fuel shortage following the security issue of the access to the project site, machineries idle time increase. Claim on delayed ROW approval and the obstruction on the Right-of-Way is affecting his progress despite the request for remove was submitted 7 months ago.

Major causes for unsatisfactory progress, which having had direct impact on project progress: -

Contractor's Responsibility: -

- Contractor's unable to take technical decision on time, excessive delay to construct protection works and unable to take employers representative command in order to commence protection works for the high embankment fill and back slopes before the coming rainy season of April and May. So that the project stopped three months
- Contractor excessive delay for asphalt paving and base course construction: contractor is unable to work according to the schedule. Lack of financial capacity to deliver required material on site.
- Excessive delay to open new sections of earthwork in the mountainous section: The Contractor has requested ROW obstruction after so many delays by his proposal for realignment from Km 51+900 to the Project End except Km 54+000 – 56+000.
- Excessive delay to finalize construction of the Bilate Bridge: The Geotechnical investigation for the bridge had been commenced late for four months and then unfavorable weather condition terminates the construction of bridge.

ERA's Responsibility

- Obstruction in the Right-of-way: Electric poles in the road prism of Yirba town section are major problem to precede construction activity.

General Demitu-Moricho DB project performance is affected by unclear scope of the work volume, undefined and uncertain ROW, complains of Woreda and Zone on route selection. Contractors poor financial management, late decision making on critical activities and lack of accepting employers representatives remind and unable to supply paving material on time are the major problem that affected the project progress. Employer representative not responding design builders request for approval of design and right of way issue on time.

This cause design builders incurred to complete the project, ERA spent a lot of money for consultancy and end users suffer in absence of access road are major effect in this project.

4.5 Summary of Discussion and Analysis

The case study and interview conducted on the challenges during implementation of Design-Build delivery system, on road projects which administered by ERA and implemented (designed and built) by local contractors is summarized below. The summery categorize the implementation gaps in to four section and includes the effects of the gap occur during DB projects delivering process on implementation (designing and constructing). The evaluation of the effect is through investigating challenges during projects implementation and checking project progress in terms of schedule certainty, Cost certainty, and clarity of projects Scope. In addition, evaluates ERA's objective of using DB delivery method.

4.5.1 Planning and Preparation Phase

Concept designing is intended to providing overall project information, including projects cost and duration. Based on these and other general information ERA procurement department set criteria for Design-Builders qualification and requirements that should bidder fulfill. Concept designers project cost estimation is a base for financial evaluation and project time estimated, it is used as one of the requirements that design builder proposal is evaluated.

According to the study projects urgency is ERA's the only reason to select DB delivery method for projects. Issues related to innovation, Proper risk allocation, quality and scope (complexity of projects) should be among the most important factors in the DB delivery method selection. Other important factors should be considered when selecting delivery system for a project, like availability of experienced contractors or the market condition which can handle it. It is better if Federal legislation or regulation present for ERA which permits or guide using the DB delivery method. For being effective; preparation before procurement is very important like proper risk identification, risk analyzing and risk allocation, Design-Builder selection mechanism and clearly identifying stakeholder's responsibility.

Poor performances of projects occur due to decision gap occur during planning and concept designing that, unclear scope of the work volume, Concept designers poor scope study, setting unrealistic project duration, lack of early discussion with Woreda and Zone authorities cause complain on route selection, which is the major cause for the delay and cost overrun of projects. To be most effective, the project risks should be well understood and definable and properly allocated

between the owner and the Design-Builder. DB delivery method requires that the project scope of work and the desired performance be fully defined through a preliminary project design development and detailed Technical Requirements.

4.5.2 Bidding Phase

Mainly two parties participated in procurement activities, ERA (employer) and Contractors (design bidders). The two parties are also primarily responsible for poor performance of projects.

- ***Employer's (ERA):-*** the major gaps which ERA committed during bidding phase of Design-Builders are; Providing short period for Design-Builders to study the project scope and identifying risks, due to unclear scope definition probably poor qualification requirement prepared and unqualified Design-Builder selected. ERA's poor communication with Woreda and Zone authorities during preparation and Concept design for the project which used to ensure the project scope, to ensure constructability and to minimize risks for proposers and for the project as whole is insufficiently characterized. Assigning incapable design review members are major gaps of ERA during procurement of design builders.
- ***Design Builder's (General Contractor): -*** during bidding local Design-Builders early project scope study and risk identification poor, also have lack of proper financial and staff management method, Technically incapable and not fulfilled some legal requirements and inexperienced with the delivery method

4.5.3 Identified gaps during DB projects implementation phase

The implementation of DB projects is administered by three parties ERA (Employer), Employers Representatives and Design-builders. Here below the gap of each contracting parties is listed

- ***Employer: -*** Late approval of Geometric Design, delay to assign consultant and delay to pay advance payment and lack of responsible person at ERA who responds design builders request for approval are the major ones.
- ***Employer Representatives: -*** Employer Representatives is responsible for on time approval of design issue, but they are unable to facilitate and respond the Right of Way problem on time, utility allocation, approval of rout selection and scope change management on time.

- ***Design Builder:*** **-** lack of capacity for innovation and poor cash flow and human resource management system, insufficient detail investigation during studying for bid submission and lack sufficient machineries and proper maintenance work shops are the major gaps during implementation. Late mobilization of materials, poor material management is also raised as a reason for poor implementation. Most of Design-Builders have no proper work schedule (plan), and have no skilled and risk taker project manager and senior professional staffs are major causes for unsatisfactory progress. Outsourcing design (absence of in house design team) staff takes big share for the delay of the project, Late request for ROW acquisition and design approval and Design-Builder design firms late providing design are also listed as a reason of unsuccessfulness of DB delivered projects.

Based on the on the studies, that DB projects which local design builders implementing it under Ethiopian Road Authority shows that they are unable to complete the project according to the schedule and with initial contract amount; contractors are challenged to fulfill the employer requirements.

4.5.4 It's Effect on Project Implementation

The above listed cases are DB projects which are handled by local contractors, administered by ERA and financed by Ethiopian federal government. From detail investigation through desk study, interview and case study possible to understand that, the implementation of DB project delivery system is not to the required level. The gap occurs in concept designing phase forwards unclear information for procurement phase. Poor procurement system ends with selection of incapable Design-Builders, poor administration and implementation, poor implementation ends with cost overrun, exaggerated delay, claims for scope change increase, poor quality and end users suffering continue. The case study indicates that Design-Builders are request for time extension, however percentage of cost overrun is small it is due to the nature of contractual agreement (lump sum) and it does not allow to claim for cost compensation Design-builders are obliged to construct it by own cost

4.5.5 ERA's Objective of DB Delivering Method

ERA's track record in implementation of the delivery system from beginning to end is seems not successful, not achieved the intended goal. ERA's Design-Build projects implementation progress indicates that, mostly projects indicates maximum time overrun, scope changes

requested by Woreda and Zone authorities and claims for time and cost compensations, therefore ERA is disadvantaged through time saving. This is mainly due to poor scope definition before awarding projects to Design-Builders. In adequate scope definition ends with setting insufficient qualification requirements for tendering, so that ERA selected unqualified Design-Builder. Most local contractors have lack of sufficient capacities and capabilities to handle DB projects. Back and forth for design request is the major challenge during implementation, these shows that communication among design firms and construction firms is poor; it is because of local Contractors have no sufficient design firms and they act as General Contractor, there is no pure Design-Builder in local condition.

ERA also spent extra amount of money for consulting firms in order to supervise. Project change request by Woreda and Zone authorities and projects alignment change and changes for town sections requests indicates ERA does not well prepare for DB delivery system.

Claim for cost compensation is lowest due to the nature of contractual agreement; it is a lump sum base, reduced potential for claims and litigation after project completion as issues are resolved by the members of the Design-Build team is major advantages through cost saving

ERA's Design-Build delivery method is not successful or not achieved the intended organizational and project objectives.

5 Conclusions and Recommendations

5.1 Introduction

Road construction projects in Ethiopia are rigorously suffering from over extended time overrun, too much cost overruns and quality problems and it affect the improvement of the country's road sector development program which intends in improving the existing poor road network. As parts of road construction project cycle selecting the right delivery method and implementing it in customary process (considering local condition) and following planned standard manuals has a significant role in the successful completion of a project. ERA using DB delivery system by setting objectives to control exaggerated time overrun, project cost uncertainty and poor quality through sharing design and construction risks.

Preparation for road construction begin by identifying project need and sufficient capital to construct the project, conducting preliminary study for the projects to ensure that the projects scope is sufficiently characterized, to ensure constructability, and to minimize risks for proposers and for the project as whole. Then setting evaluation criteria for appropriateness of the delivery mechanism for specific project and conducting it accordingly. Developing project delivering selection mechanism, assessing suitable delivery method and selecting appropriate delivery method for the project is mandate of the Program directorate of the road authority. It most important to recognize that selection of the suitable delivery method for project is determines performance of the project.

Having the above information is promising to employer to achieve the intended project objective. The study on challenges during implementation of DB projects delivering mechanism indicates that, to achieve DB projects objective the following three stages should be conducted appropriately

- Proper planning, preparation of appropriate delivery strategy
- Appropriate bid evaluation and risk sharing mechanism.
- Selection and awarding to qualified design-builder according to method of bidding

Based on the study made on ERA implementation mechanism of DB projects delivering process, it is found that the most critical factors in the delivering process which results poor performance

of project implementation, are Planning, Preparation (preparation of tender documents and scoping of the project), bid evaluation and selection of potential DB contractors. Hence, the following conclusions and recommendations for the above most critical identified factors are forwarded.

5.2 Conclusions

Planning and Preparation

I. ERA use projects urgency as a major reason to use DB project delivery method. Forgetting other factors such as size and complexity of the projects, and no Federal rules and regulations for Design-Build delivery method selection and to use innovative project delivery techniques.

II. According to the findings the time allowed by ERA for investigation does not considered project scope, access roads, and these leads poor scope definition.

III. The study indicates that concept designer's data is not detail; Potential projects risks did not carefully reviewed. These causes estimation of wrong projects cost and durations, and unclear project scope is determined.

IV. ERA do not have milestones or review plane to revise concept design during preliminary study, and professionals assigned by ERA to review design documents are junior Engineers and do not have a capacity to control the required quality of design documents

V. ERA's preparation for DB projects delivering is not sufficient enough; do not follow appropriate procedures to selecting Design-Builders. Scope definition is not clearly defined, concept designer's project duration estimate is not reasonable and which does not considered projects work volume. Also there is no a strong mechanism to control the quality of tender documents prepared by Design-Builders, most of the local design builder's tender documents are prepared by freelancers. This will result unsatisfactory service delivery.

Bid Evaluation

VI. ERA's basis for proposal evaluation (basis of award): includes price and non-price (i.e., technical considerations) evaluation criteria through post-qualification in single-phase procurement process.

VII. According to study ERA award the contract for lowest evaluated bidder, which means cost is bases of selection, and bidder which fulfill minimum technical qualification is selected.

VIII. ERA evaluate Contractor's performance on ongoing projects is solely based on financial progress and duration of projects, forgetting overall management of projects and formula used for calculation of the expected performance of contractors, is not in line with the actual expected cash flow progress. It is made in monthly basis and may results contractors to focus in fulfilling a performance requirement of a specific month based on the intention to participate a specific tender and non-uniform disqualification of contractors.

Challenges of DB Projects Implementation

IX. The finding indicates that Design-Builders are challenged to get on time approval of design issue, late approval and lack of continuous comment. Some Employers Representatives and ERA project coordinators do not give approvals on time, this leads for contractors to precede construction before design approval of ERA, casus time overrun of projects and cost overrun.

X. According to the study Design-Builder level of understand project scope is poor; lack of detail data collection during tendering, risks are not properly identified, and lack of accurate scope management system expose for cost overrun and delay.

XI. Design-Builders are also challenged in implementing DB projects due to unclear scope defined by owner, (Woreda and Zone authorities) complain on route alignment and design change, town section change request and ROW problems are routine challenges,

5.3 Recommendations

Based on the findings of the study, the following recommendations are put forward for improvement of the current practices of ERA's DB projects delivery mechanism.

The following recommendations are forwarded to *ERA*

i) ERA should properly plan, conduct a proactive and objective assessment of the unique characteristics of projects through Project Delivery Selection Matrix (PDSM) before deciding to use Design-Build delivery system and prepare before procuring DB projects constructors. The planning and preparing should include size and complexity of the project, available budget for the project; legal and regulatory ability to use various innovative project delivery techniques, capability and creativity of the contracting agency; and setting appropriate risk assessment and allocation mechanism.

ii) ERA should give sufficient time to concept designers and Design-builders in order to come up with full project information. Full preliminary projects information allows the organization to assess the appropriateness of design-build for the project, identify risk and allocate risks to the right parties who can handle properly, it allow to understand project scope clearly and could prepare appropriate scope management system.

iii) The milestones or review plane, to revise concept design and design builder's design during project implementation should be fixed with different time interval and potential professionals should be assigned to solve design issue and approval on time.

iv) ERA's project duration estimation should consider project scope or the work volume, local contractor's capacity and capabilities, the weather condition.

v) ERA should focus heavily on the qualifications of the Design-Builder and its key team members rather than price or best-value procurement; and rewards design-build teams that have a demonstrated history of successfully collaborating on design-build projects. Also identify and involve key project stakeholders at the early stages of project. All design-build team members should be educated and trained in the design-build process, and be knowledgeable of the differences between Design-Build and other delivery systems.

The following recommendations are forwarded to Design-Builders

vi) Design builders should understand the project scope clearly over detail data collection and investigation during tender document preparation and properly identifying project risks.

vii) Local design builders, better to have in house design firms, rather subcontracting designers; or it is also a good option if they come with joint venture to share both the benefits and project risks proportionally. Designers early or on time design completing highly facilitate project progress, and likely projects completed on time.

viii) Local Design Builders should increase the capacity and capability of implementing Design-Build projects. It is possible three or more design builders to come up together in joint venture, can provide high quality construction service with original cost and schedule certain way.

ix) Local Design-Builders should improve financial management, labor management, material and machinery management system, and form proper schedule for major activities.

The following recommendations are forwarded to Employer Representatives

x) ERA Representatives should properly and on time response for scope changes requested by Wored and Zone complaining on rout alignment and Right of Way.

xi) Should approve design requested by Design-Builders on time and allocate utilities early by coordinating with ERA.

5.4 Recommendation for Further Study

This research was aimed at investigating an effective approach to Design-Build Project Delivery System in Ethiopian Road Authority for local design-builders. Implementation mechanism of Design-Build is still not to the required level in the road construction. Therefore, the primary need for future research involves evaluation and modification of the current Design Build practices in ERA. The necessary research areas identified for further study and recommended topics are the following.

i. Study on ERA risk allocation mechanism and change management system for Design-Build projects, and developing risk identifying and allocation matrix. The study helps ERA to how exercise risk identification and allocation easily.
ii. Studying capacity and capability of local contractors to handle Design-Build road projects. Local design-builders faced shortage of machineries, liquid finance and skilled manpower, so that it may give a good insight for design-builders to come up with sufficient resource, and also provide better option for ERA to revise design-builders qualification criteria.

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Appendix – Interview

Dear participant,

I am undertaking a research study entitled "Study on the challenges Design-Build Delivery System, in Ethiopian Road Authority Projects" as part of my MSc. Study in Construction Technology and Management at Addis Ababa University, Addis Ababa institute of Technology. This research is aimed to investigate the problems on DB projects delivery system implementation and to recommend improvement on the delivering process in Ethiopian Roads Authority.

Therefore it is important to identify gaps on DB projects delivering process which negatively affect the project's success criteria (goal) i.e. time, cost and quality; in addition to this identifying ERA's objective of practicing the delivery system is weather achieved and subsequent recommendation of the possible solutions towards minimizing the problem.

To successfully conduct this research, it is mandatory to look into the issues from different perspectives through interviewing by involving professionals who have experience in the Ethiopian road construction sector. In this respect, interview questions are prepared for Client (in this case ERA), Design Builders, Employers representatives and Concept designers. You are the one who can give the correct information; hence I kindly request you to respond to the questions.

I would like to confirm you that your response will be kept strictly confidential and it will be used solely for the purpose of this research.

Thank you very much for your time and cooperation,

Kind Regards,

Sisay Lombasso

I. Interview Questions for Design-Builders

1 General Profile of the Respondent

1 Name: *(Optional)*_____

2 Position: _____

3 How long have you worked in the road sector

☐ 0-5 Year ☐ 11-15 Year

☐ 6-10 Year ☐ Above 15 Year

2 Project Characteristics

2.1 Project location (Region)_____

2.2 Total length of road _____ KM

2.3 Project contract period.

- ✓ Elapsed in _____ (Days) or
- ✓ Completed percentage % (if not complete) _____%

2.4 Contract completion period _____ (Days)

Describe the nature of this project. (Check a box)

☐ New Construction ☐ Rehabilitation

☐ Upgrading ☐ Other

3 Procurement

3.1 Did you have past work experience with the selected design-build project delivery?

☐ Yes ☐ No

✓ If Yes, How many D-B projects have you executed before? (Check a box)

☐ One ☐ Two

☐ Three ☐ Three plus

3.2 In what stage does ERA invited your organization for procurement current project?

a. In preliminary stage

b. After preparing "Bridging"

3.3 Does detail investigation and bid preparation (document preparation) time is sufficient?

☐ Yes ☐ No

✓ No, what do you recommend? ……

3.4 Does ERA project scope definition or Schematic design document prepared is clear?

☐ Yes ☐ No

✓ No, what is the reason? ……..

3.5 Do you think that ERA bid evaluation mechanism is impartial and follow correct procedure

☐ Yes ☐ No

✓ NO, what is the problem? …….

✓

3.6 Do you think that concept designer's minimum project duration to procure DB projects is sufficient?

☐ Yes ☐ No

✓ Yes or No do you think it is correct way?

:_____

:_____

3.7 What were the major challenges you faced during the document preparation?

:_____

:_____

3.8 Do you think that selecting the least bidder for DB projects is good?

:_____

:_____

3.9 How is the owner's requirements & contract document not to limit innovation and flexibility?

☐ The owner insists on absolute design control

☐ It allows flexibility and innovation

☐ The owners program is somewhat tight in allowing flexibility and innovation

4 Design-Building

4.1 Which type of contract management do you practiced?

☐ As a general contractor

☐ By joint venture

☐ By consortium

☐ Other (Please specify)_____

4.2 How did you manage the design activity?

☐ By using in house design staff

☐ By outsourcing the design work

4.3 If design is outsourced (if yes), do you think that outsourcing the design work is equally effective to in house designing?

☐ Yes ☐ No

✓ If No, How? _____

4.4 Are designers delivered the required design on time?

☐ Yes ☐ No

4.5 Do ERA professionals offer their continuous comments on design submittals in a timely manner (QA/QC)?

☐ Yes ☐ No

✓ If Yes, utilizes

- ☐ Informal (over-the-shoulder reviews)
- ☐ Formal design reviews.

4.6 Does ERA have a milestones or review plan, to revise design during construction phase?

☐ Yes ☐ No

✓ If yes in specify in what stage_____

4.7 Does ERA have a standard process to receive, Evaluate, and approve ATCs for design-build projects that benefit from innovation?

☐ Yes ☐ No

✓ If yes, to what extent_____

4.8 If delay occurs, what are the major causes of delays in your project?

- ☐ ROW problem
- ☐ Design change
- ☐ Utility allocation
- ☐ Adverse weather condition
- ☐ Late payment
- ☐ Shortage of material
- ☐ Other (please specify) _____

4.9 If cost overrun occurs, what are major causes of cost overrun in your project?

- ☐ ROW problem
- ☐ Utility allocation
- ☐ Design change
- ☐ Inflation (currency)
- ☐ Other (please specify) _____

4.10 If variation (scope change) occurs, what are major causes of Variation in your project?

- ☐ ROW problem
- ☐ Utility allocation
- ☐ Design change (by whom)
- ☐ Price escalation or currency
- ☐ Other (please specify) _____

4.11 Do you think that speed of delivery maintained in DB delivery method?

☐ Yes ☐ No

4.12 Do you think that project cost is kept in DB delivery method?

☐ Yes ☐ No

4.13 Do you think that good project quality is attained in DB delivery method?

☐ Yes ☐ No

4.14 Do you think that contractor's project risk is better manageable in DB delivery method?

☐ Yes ☐

4.15 Did the delivery system enhance or hinder your ability to perform well in terms of time, cost, and quality?

☐ Yes it enhances ☐ Yes it hinders

☐ I do not know ☐ Not Applicable (for consultants)

- ✓ If it hinders what is your proposal to improve?

:_____
:_____

4.16 What are the major challenges which you face in the course of DB implementation?

:_____
:_____

4.17 How do you define the implementation of the DB project under ERA

- ☐ Is very complex
- ☐ Is moderately complex
- ☐ Is not complex

- ✓ If it is complex, what makes it complex?

:_____
:_____

4.18 Do you think that Experience of local contractors is capable to do DB projects, in terms of key-design personnel, machinery and financial capacity?

:_____
:_____

4.19 What is your recommendation for DB contractors to cope up with this delivery method?

:_____
:_____

4.20 What is your recommendation for ERA to cope up with this delivery method?

:_____
:_____

4.21 DO you have any comment on ERAs general DB management system (design manuals, and concept designing)?

:_____
:_____

4.22 What are the strengths you well-thought-out in Design-Build delivery system?

:_____
:_____

II. Interview Questions for Employer (ERA)

1. **Profile of the Respondent**

1.1 Name:*(Optional)*_____

1.2 Position:_____

1.3 How long have you worked in the road sector (ERA)

☐ 0-5 Year ☐ 11-15 Year

☐ 6-10 Year ☐ Above 15 Year

2 Owner (ERA) DB Projects Information

2.1 How long has ERA used Design-Build for road projects?

☐ 5years ☐ 10 years ☐ 15years ☐ +15years

2.2 Describe current state of this DB projects.

- ✓ To date progress of projects (_____ (Days) or
- ✓ Completed percentage % (if not complete) _____%

2.3 Describe the nature of these projects. (Check a box)

- ✓ Length of New Construction_____ Length of Rehabilitation_____
- ✓ Upgrading_____ Other_____

3 Procurement

3.1 Does ERA have criteria to select DB project delivery method for projects?

☐ Yes ☐ No

- ✓ Revising it……

3.2 Does ERA have a risk assessment and allocation module for risks on progress?

☐ Yes ☐ No

- ✓ Revising it……

3.3 Which of the following DB operational system did ERA prefer from contractors?

☐ Bridging Design-Build

☐ Preliminary Design Design-Build

☐ Design Criteria Design-Build

☐ Direct Design-Build

3.4 What percentage of design is completed before a project goes out to bid?

☐ >10% ☐ >20% ☐ >30/% ☐ 40% 100% ☐

3.5 What is your agency's selection process for the Design-Builders?

☐ RFQ

☐ RFP

☐ Best Value

☐ Lowest Bid

☐ Other (please specify) ……

3.6 Do you think that selecting least bidder is good for projects performance?

☐ Yes ☐ No

3.7 What were the major challenges you faced during the procurement of Design-Builder?

:_____

:_____

3.8 Do DB local contractors, technical financial, personal; fulfill employers (ERA) Requirements?

☐ Always ☐ In most cases

☐ Sometimes ☐ Rarely

3.9 Does ERA have a milestones or review plane, to revise design during concept designing phase?

☐ Yes ☐ No

✓ If yes in specify in what stage_____

3.10 Do you think that concept designers, time, cost estimation is satisfactory for Design Builders?

☐ Yes ☐ No

3.11 Do you think that time allowed for design builders document preparation is sufficient?

☐ Yes ☐ No

4 Implementation

4.1 Is there any frame work does ERA have to control implementation progress of DB projects?

☐ Yes ☐ No

✓ If yes can I have it? _____

4.2 Does ERA provide staff training regarding your Design-Build program?

☐ Yes ☐ No

✓ If YES, please explain:

: _____

4.3 Does ERA have variations range from minimal contract performed?

☐ Yes ☐ No

✓ If Yes, ☐ 0% -5% ☐ 5%-10%

☐ 10-20% ☐ 20%-30%

✓ If No, how changes are managed

_____

_____

4.4 Does ERA have a standard process to receive, Evaluate, and approve ATCs for design-build projects that benefit from innovation?

☐ Yes ☐ No

✓ If yes, to what extent

_____

_____

4.5 Are there any identified Key Performance Indicators of DB projects which practiced in ERA?

☐ Yes ☐ No

✓ If yes, which of the following is practiced widely? Mark all you were practiced

☐ Cost reporting
☐ Time controlling mechanism
☐ Quality of work
☐ Health and safety
☐ Resource management
☐ Cost/unit
☐ Rework/quality control
☐ If any other_____

4.6 In which of the following does your agency has benefited by achieving DB system? Select all that apply

☐ Time savings
☐ Improved (cost) budget control
☐ Reduction in staff workload Reduction
☐ Innovative design
☐ Reduce change orders
☐ Improved Public Relations
☐ Minimize risk order
☐ Other (please identify) _____

4.7 What is your agency's track record in administering DB projects from beginning to end?

☐ All have been major successes
☐ Majority have been successful but a few have been problematic
☐ Successful except for lawsuits by contracts (on very large projects)

4.8 What are the major causes of delays in your projects?

☐ ROW problem
☐ Scope change due to stakeholders
☐ Adverse weather condition
☐ Late payment approval

☐ Other (please specify) _____

4.9 What are the major causes of cost overrun that occurred in your projects?

☐ ROW problem
☐ Utility allocation
☐ Scope change
☐ Price escalation (currency)
☐ Adverse weather condition
☐ Other (please specify)_____

4.10 What are major causes of Variation that occurred in the DB road projects?

☐ ROW problem
☐ Utility allocation
☐ Design change (by whom)
☐ Price escalation or currency
☐ Other (please specify)_____

4.11 Do you think that speed of delivery kept by using DB delivery method?

☐ Yes ☐ No

4.12 Do you think that project cost is kept by using DB delivery method?

☐ Yes ☐ No

4.13 Do you think that good project quality is attained by using DB delivery method?

☐ Yes ☐ No

4.14 Do you think that ERA's design and construction risks are manageable by using DB delivery method?

☐ Yes ☐ No

4.15 From your experience do you think that DB delivery method is best suit for local contractors, (local contractors are capable technically/personally (staff), financially?

☐ Yes ☐ No

✓ If No, What do you recommend for change?

_____

_____

4.16 What is your recommendation for design builders to cope up with efficiency and effectiveness?

:_____

:_____

4.17 DO you have any comment on ERAs DB contractual methods?

:_____

:_____

4.18 What is major challenge that you face during implementation DB delivery method

:_____

:_____

III. Interview Questions for Employers representative

1 General Profile of the Respondent

1.1 Name: *(Optional)* _____

1.2 Position: _____

☐ 0-5 Year ☐ 11-15 Year

☐ 6-10 ear ☐ Above 15 Year

2 Project Characteristics

2.1 Project location (Region)_____

2.2 Total length of road _____ KM

2.3 Project contract period.

- ✓ Elapsed in _____ (Days) or
- ✓ Completed percentage % (if not complete) _____%

2.4 Contract completion period _____ (Days)

Describe the nature of this project. (Check a box)

☐ New Construction ☐ Rehabilitation

☐ Upgrading ☐ Other

3 Contract Administration

3.1 Did you have past experience on consulting (employer representative) of DB projects?

☐ Yes ☐ No

- ✓ If Yes, How many?

☐ One ☐ Two

☐ Three ☐ Three plus

3.2 Does ERA project scop definition or contract document prepared is clearly defined?

☐ Yes ☐ No

- ✓ If No, what is your company got challenge due to poor scope definition? Please list all

:_____

:_____

3.3 Do monthly progress report from design builder is provided on time?

☐ Yes ☐ No

3.4 Does ERA's final design controlling influence contractors design freedom?

☐ Yes ☐ No

- ✓ If Yes, why?

:_____

:_____

3.5 Do you think that ERA risk allocation mechanism for DB project is correct?

☐ Yes ☐ No

- ✓ If No, what do you recommend?

:_____

:_____

3.7 In your projects, are there any adversarial relation/ dispute among contracting parties?

☐ Yes ☐ No

✓ Yes what was the reason

:_____

:_____

3.8 If project delays occur, what are major causes of delays that occurred in your project?

:_____

:_____

3.9 If cost overrun occurs, what are major causes of cost overrun that occurred in your project?

:_____

:_____

3.10 If scope change occurs, what are major causes of scope change that occurred in your projects?

:_____

:_____

3.11 If dispute occurs what are major causes of dispute/ claim that occurred in the DB road projects?

:_____

:_____

3.12 Do you think that schedule certainty is achieved by using DB delivery?

☐ Yes ☐ No

3.13 Do you think that project cost certainty is kept in DBDS?

☐ Yes ☐ No

3.14 Do you think that good project quality is attained in DB?

☐ Yes ☐ No

3.15 Do you think that ERA's project risk is better manageable in DB?

☐ Yes ☐ No

3.16 Does contractor fulfill all required facilities on contract agreement?

:_____

:_____

3.17 In your project is there problems related to design change order

☐ Yes ☐ No

✓ If yes which party is requested for?

:_____

:_____

3.18 What is your recommendation for DB contractors to cope up with DB delivery method?

:_____

:_____

3.19 What is your recommendation for ERA to cope up with this situation?

:_____

:_____

3.20 How do you define the contract administering of the DB project under ERA

- ☐ Is very complex
- ☐ Is moderately complex
- ☐ Is not complex

If complex what makes it complex?

:_____

:_____

3.21 What were the major challenges you faced during the administering of DB projects? (Check a box)

- ☐ Environmental analysis and permitting
- ☐ Right of way acquisition
- ☐ Utility relocation
- ☐ Alternative Technical Concept(ATC) assurance
- ☐ Design oversight, design acceptance and Quality management
- ☐ Other (please specify) _____

IV. Interview Questions for Concept designers

1 General Profile of the Respondent

1.1 Name: *(Optional)*_____

1.2 Position: _____

1.3 How long have you worked in the road sector

☐ 0-5 Year ☐ 11-15 Year

☐ 0-6 Year ☐ Above 15 Year

2 Project Characteristics

2.1 Project location (Region)_____

2.2 Total length of road _____ KM

2.3 Project contract period.

- ✓ Elapsed in _____ (Days) or
- ✓ Completed percentage % (if not complete) _____%

2.4 Contract completion period _____ (Days)

Describe the nature of this project. (Check a box)

☐ New Construction ☐ Rehabilitation

☐ Upgrading ☐ Other

3 Designing Phase

3.1 Did you have past experience on concept designing of design-build projects?

☐ Yes ☐ No

✓ If Yes, How many?

☐ One ☐ Two

☐ Three ☐ Three plus

3.2 How do you define the concept designing of the DB project under ERA compared to DBB?

☐ Is very complex

☐ Is moderately complex

☐ Is not complex

3.3 Does ERA provide a standard process (milestones) to receive, Evaluate, and approve concept design during development phase?

☐ Yes ☐ No

✓ If yes in specify in what stage_____

_____

3.4 What percentage of design is completed before a project goes out to bid?

☐ >10% ☐ >20% ☐ >30/% ☐ 40%

3.5 What are responsibilities of concept designer after project is awarded to Design Builder?

:_____

:_____

3.6 Do you think that level of design to determine project scope prior to procurement to get accurate/comprehensive responses from design builder is satisfactory?

☐ Yes ☐ No

3.7 What do you think that major challenges you faced during concept designing?

:_____

:_____

3.8 Do you think that DB delivery method is best suit for local contractors (financially, labor, technically)?

☐ Yes ☐ No

- ✓ If No, What do you recommend for change?

:_____

:_____

3.9 Do you think that early contractor involvement enhances the constructability of the engineered project plans for local contractors?

:_____

:_____

3.10 Do you think that fast-tracking of the design and construct portions of the project (overlapping) is a time saving for local contractors?

:_____

:_____

3.11 What is your recommendation for DB contractors to cope up with delivery method

:_____

:_____

3.12 What do you recommendation for ERA on DB projects delivery method implementation?

:_____

:_____