



**REPUBLIC OF GHANA**

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# **PERFORMANCE AUDIT REPORT OF THE AUDITOR-GENERAL ON SELECTED ROAD WORKS IN GHANA**

- (1) EAST LEGON – SPINTEX ROAD UNDERPASS,**
- (2) EASTRN CORRIDOR ROAD PROJECT LOTS 5 & 6 AND**
- (3) THE OIL AND GAS ENCLAVE ROADS**



**This report has been prepared in compliance with Article 187(2) of the 1992 Constitution of Ghana and Section 13(e) of the Audit Service Act, 2000 (Act 584)**

**Daniel Yaw Domelevo  
Auditor-General  
Ghana Audit Service  
28 November 2019**

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## **TRANSMITTAL LETTER**

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Dear Mr. Speaker,

### **PERFORMANCE AUDIT REPORT OF THE AUDITOR-GENERAL ON (1) EAST LEGON – SPINTEX ROAD UNDERPASS, (2) EASTERN CORRIDOR ROAD PROJECT LOTS 5 & 6, AND (3) THE OIL AND GAS ENCLAVE ROADS**

I have the honour, in accordance with Article 187(2) of the 1992 Constitution of Ghana, Sections 13(e) and 16 of the Audit Service Act, 2000 (Act 584) to present to you a performance audit report on selected roads.

The Government of Ghana invested GH¢ 8.24 billion in construction of new and upgrading of old roads between 2012 and 2018 mostly funded by loans.

Ghana Highway Authority’s mandate by Act 540 of 1997, is to design and supervise the construction of trunk roads and in some cases render consultancy services to ensure contractors meet specification.

The rampant deterioration of roads few months after their completion and handing over has been a concern to many Ghanaians and the question has been asked about the quality of the road works carried out. Similarly, complaints abound about delays in completing road works due to variations and delayed payments contributing to cost overruns because of fluctuations and in many cases interest on delayed payments.

Roads are integral part of the transport system as it links main cities, towns and villages. It links agricultural production areas with local, regional and national markets and it carries in excess of 97% of all passenger and freight traffic in Ghana and thus a main economic player.

The purpose of the audit was to assess and give assurance to Government that GHA ensures roads awarded and constructed under their supervision meet the required standards and guarantees Value for Money

We scoped three road projects constructed between 2012 and 2019, under “**Contractor design and build arrangement**” for the audit. The roads were the East Legon – Spintex Road Underpass, Eastern Corridor Road Project Lots 5 & 6 and the Oil and Gas Enclave roads which were under implementation from 2014 to 2019 by the Ghana Highway Authority (GHA) to determine whether they met the required standard specifications and guaranteed Value for Money.

Our audit disclosed that GHA did not compile feasibility data on roads to aid in reviews of project designs presented by contractors.

GHA approved preliminary designs for the projects to commence, but detail designs were prepared during project implementation that resulted in significant changes to the original scope. This partly contributed to an increase in project duration and cost. In some instances, GHA eliminated items in the original scope to keep within a fix budget.


Contractors and Consultants were either sole source or through restrictive tendering partly due to lack of proper planning of the projects.

I have made recommendations to GHA, in the area of project planning, budgeting and implementation to bring about improvement in road construction to ensure the country gets Value for Money for such projects

I also recommended to GHA to institutionalise prescribed maintenance schedules to prolong road life in the country.

I trust that this report will meet the approval of Parliament.

Yours faithfully,



**DANIEL YAW DOMELEVO**  
**AUDITOR-GENERAL**

**THE RIGHT HON. SPEAKER**  
**OFFICE OF PARLIAMENT**  
**PARLIAMENT HOUSE**  
**ACCRA**

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## EXECUTIVE SUMMARY

1. Roads contribute significantly to the socio-economic and cultural development of a country. In Ghana, the Ministry of Roads and Highways estimates the country's road network to be about 78,401 km as of December 2017. Between 2012 and 2018, government invested a total amount of about GH¢ 8.24 billion in the construction of new and upgrading of old roads.
2. Despite the investments in the road sector, citizens are worried about the constant deterioration of roads, months after they have been completed. There are concerns as to whether these roads funded by Government from internal sources and external loans meet prescribed quality specifications and are worth the cost, time spent and can serve their design life.
3. In view of this, the Auditor-General under his mandate in the Audit Service Act (Act 584), 2000, Section 13(e), commissioned an audit of selected roads in the country.

### WHAT WE DID

4. We selected three road projects constructed between 2012 and 2019, under **Contractor design and build** arrangement for the audit. The roads were the East Legon – Spintex Road Underpass, Eastern Corridor Road Project Lots 5 & 6 and the Oil and Gas Enclave roads which were under implementation from 2014 to 2019 by the Ghana Highway Authority (GHA) to determine whether they met the required standards specifications and guaranteed Value for Money.
5. The audit focused on whether GHA;



- i. followed accepted procedure and good practice in planning for road projects (Feasibility studies, design and budgeting),
- ii. followed due process in the engagement of consultants and contractors to execute the selected road projects,
- iii. put measures in place to deliver the selected road projects within scope, cost, time and to quality standards, and
- iv. ensured the road projects were completed and all relevant certificates issued (Contract documentation and maintenance schemes).

We reviewed documents related to the selected roads, interviewed persons involved in the procurement and execution of the roads as well as inspecting the site to take asphalt cores that we tested in the laboratories for compliance to specifications. By so doing, we were able to provide answers to our audit questions and to conclude on our audit objective.

## **WHAT WE FOUND**

### **Planning for road projects**

6. GHA did not have compiled feasibility data on roads to aid in reviews of project designs presented by contractors. GHA approved preliminary designs which were not detailed enough for the three projects to commence. Detailed designs were however provided during implementation which resulted in significant changes to the original project scope. Estimates provided by GHA for the three projects were based on preliminary designs and provisional sums which resulted in variations, increase in project duration and project budget.

## **Procurement of consultants and contractors**

7. The audit team could not validate the fairness and transparency of the procurement of contractors for the East Legon – Spintex Road Underpass project, Eastern Corridor Road Project and the Oil and Gas Enclave Road Project due to the absence of evaluation reports and approval letters on the projects. GHA used Sole sourcing and restrictive tendering to procure contractors and consultants partly due to the fact that the projects were not planned to allow for competitive sourcing based on the principles of Value for Money.

## **Implementation of the road projects (managing scope, cost, time and ensuring project quality)**

8. GHA ensured adherence to specification on the East Legon to Spintex Road Tunnel project. However, the project had scope changes during implementation due to the lack of traffic studies, as a feasibility study was not carried out on the project. The contractor requested for an extension of six months of the project completion time to enable him execute the changes GHA introduced on the Project.
9. GHA commenced the Eastern Corridor road project with preliminary designs which resulted in variations and a reduction of the of the project length by 41.3km. The project, which was scheduled to be completed on 4 November 2016 was 76% complete at the time of the audit. The Ministry of Roads and Highways compensated the contractor with US \$ 23,762,165.35 and a 21 months extension due to delays in payment.
10. The Oil and Gas Enclave road project commenced without detailed feasibility and engineering studies which resulted in delay of the project and cost overruns. The project delayed due to variations, compensation of

project affected persons, relocation of utilities and claims for delay in payment in completion.

### **Completion and documentation**

11. GHA issued completion certificates for the East Legon to Spintex Road Tunnel and the Oil and Gas Enclave Road Projects on 28 August 2018 and 21 March 2018 respectively. As at the time of the audit, Resident Engineers on the project had prepared a snag-list containing defects to be rectified prior to final handing over of the two projects to GHA.
12. The Filing and maintenance of project documents was incomplete as different categories of documents were mixed in the project files, making it difficult to have a complete trail of the progress of the projects.

### **Recommendations**

13. For GHA to review data provided by contractors engaged in Design and Build contracts, we recommend that GHA should;
  - i. draw a plan and support the Survey and Design Division to prepare feasibility studies and compile data to cover roads earmarked to be developed in their strategic plans.
  - ii. plan for future projects to ensure that all relevant information needed for the project to take off, as per Section 3 (1) (g) of Act 540 are available in the form of a feasibility study report.
  - iii. detail drawings are made available before projects are started.

- iv. prepare estimates based on detailed designs rather than preliminary designs to avoid arbitrary variations and to promote transparency in the process
  - v. ensure that complete designs and drawings are made available for any project it intends to implement, with its complementing bill of quantities prior to tendering
14. To improve fairness and transparency in procurement of consultants and contractors, GHA should make use of competitive tendering by improving upon their planning process.
15. To ensure proper implementation of current and future road projects, we recommend that GHA should;
- i. cease forthwith implementation of any project which does not have secured and available funding capable of meeting all projected costs.
  - ii. institute and implement a policy on processing time for each stage of the validation process of IPCs to guide against undue delays beyond 56 days and sanction officers who delay each IPC with cost of claims due to the delayed IPC,
  - iii. reduce the clearing process of Interim Payment Certificate where possible.
  - iv. seek approval for all variation in accordance with Section 87 of the PPA Act 2016 (Act 914) before implementation
  - v. reject any works done by contractors which do not meet contract quality specification and ensure such works are redone to quality.

- vi. Institutionalise prescribed maintenance regime to prolong road life after construction

# CHAPTER ONE

## 1.0 Introduction

### 1.1 Reasons for the Audit

16. Roads play an essential part of economic development and can contribute significantly to the socio-economic and cultural development of any country. A good road network helps to link communities together and enhances commerce, thereby improving the economic wellbeing of the citizens. Roads have also enhanced cultural exchanges between communities and have contributed to improved access to health care facilities in a timely manner.

17. Roads are integral part of the transport system as it links main cities, towns and villages. It links agricultural production areas with local, regional and national markets and it carries in excess of 97% of all passenger and freight traffic in Ghana.

18. The Ministry of Roads and Highways estimates that Ghana has about 78,401 km of road network as of December 2017. Of this, 14,583 km are trunk roads, 48,357 km are feeder roads and 15,462 km are urban roads. These roads play a significant role in Ghana's economy as road transport is the most widely available form of transport (96%)<sup>1</sup> in the country. At a

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<sup>1</sup> <https://www.gipcghana.com/invest-in-ghana/why-ghana/infrastructure/transportation-infrastructure.html> (accessed on 18 Jul. 19)

press briefing, the Minister of Roads and Highways, revealed that about 61 per cent of roads in the country are classified as poor<sup>2</sup>.

19. Between 31 December 2012 and 1 January 2018, a total amount of about GH¢ 8.24 billion<sup>3</sup> was spent on construction of new and upgrading of old roads. Despite the investments in the road sector, drivers and passengers alike are worried about the constant deterioration of roads, months after they have been completed and handed over by contractors. The frequent repairs and maintenance of the same roads repeatedly with attendant cost implications, mean that new ones are never considered and undermines government's quest to expand the road network.

20. Ghana as a country is unable to finance road construction solely from internally generated funds and has to resort to borrowing with interest payments from international financial institutions such as World Bank, African Development Bank, European Union, Japan bank for International Co-operation etc. It becomes a double agony when a road constructed from a loan starts deteriorating when the loan is yet to be settled. The public has expressed similar sentiments and concerns about extended construction time of roads in Ghana. In some instances, a road project scheduled to be completed within 24 calendar months sometimes take 60 months or more to complete.

21. With ever increasing budgetary demands from various sectors such as Health Care, Agriculture, Education etc. there is the need to ensure that

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<sup>2</sup> url: <https://www.myjoyonline.com/news/2017/December-31st/61-of-ghanas-classified-as-poor.php>

<sup>3</sup> Total disbursement by MRH from 2013 to 2017

moneys allocated for road construction are properly used. Year by year budgetary allocation for roads works continue to increase as the road network is estimated to grow. For instance, between 2014 and 2017 the Ministry of Roads and Highways planned budget increased from GH¢ 2.1 billion to GH¢ 6.7 billion. Proper planning and budgeting are therefore required to ensure value for money to reduce the wastage, inconvenience to motorists and save the country's money. It must therefore be a priority that these roads meet the prescribed quality specifications, cost and time, to serve their built-in project life.

22. In view of this, the Auditor-General under his mandate in the Audit Service Act (Act 584), 2000, Section 13(e), commissioned this Performance Audit to assess and give assurance to Parliament and the general public that roads constructed and supervised by the Ghana Highway Authority (GHA) meet the required standards and ensure value for money.

## **1.2 Audit purpose and scope**

### **1.2.1 Purpose**

23. The purpose of the audit was to assess and give assurance to government that GHA ensures roads awarded and constructed under their supervision meet the required standards and guarantees Value for Money.

### **1.2.2 Scope**

24. We carried out the audit on three selected Ghana Highway Authority supervised roads, under implementation from 2012 to 2019. We carried out the audit from March to June 2019 and focused on.

- v. Planning (Studies, design and budgeting)



- vi. Procurement of Contractors and Consultants (Selection and award of contract)
- vii. Execution of the project (managing scope, cost, schedules and ensure project meets quality specifications)
- viii. Closure of the projects (Contract documentation and maintenance schemes)

### **1.3 Audit Objective**

25. The objectives of the audit were to assess and determine within the focus of the audit, whether GHA:

- followed accepted procedure and good practice in planning for road projects,
- followed due process in engagement of consultants and contractors to execute the selected road projects,
- put measures in place to deliver the selected road projects within scope, cost, time and to quality standards, and
- ensured the road projects were completed and all relevant certificates issued (Contract documentation and maintenance schemes)

### **1.4 Methodology**

26. We carried out the audit in accordance with the general requirement of INTOSAI auditing standards for performance audit (ISSAI 3000). These standards require that the audit is planned and performed in a manner as to obtain reasonable assurance that the audit objectives are met. A technical

consultant, with over 20 years in civil and road construction was engaged for the period of the audit to provide technical support to the audit team. In accordance with Section 29(1) of the Audit Service Act 2000, Act 584, GHA was given 30 days to respond to our observations in the Management letter per or letter dated October 18, 2019 reference PSAD/PAU/PROJ/09/05.

### **1.4.1 Sampling**

27. The audit team sampled eight road projects from the progress reports on ongoing GHA project contracted under Works Designed by the Contractor arrangement. Out of the sample, three projects were selected for the focus of the audit. The projects were selected based on:

- Status of completion
  - The audit team selected roads which should have been completed by 31 December 2018.
- Type of pavement
  - We selected Asphaltic roads due to the high cost of construction of these roads and the possibility of using the asphalt coring machine to take core samples for measurement and testing.
- Cost
  - The team selected projects which had exceeded their initial contract sum.
- Location

- The road projects were selected from the Greater Accra, Northern, Oti and Western Regions as the first phase of our ongoing audits.
- Source of funds
  - The road projects were funded through both GoG and foreign components.

28. On basis of the criteria above, the audit team selected the road projects shown in Table 1.

**Table 1: Road Projects Selected for Audit**

No.	Project	Region	Year commenced	Expected year of completion	Initial Contract Sum
1	East Legon – Spintex Road Underpass	Greater Accra	2017	2018	GH¢ 14,815,261.46
2	Eastern Corridor Road Project Lots 5 & 6	Oti and Northern	2014	2016	US\$ 290,642,200.00
3	Oil and Gas Enclave roads	Western	2014	2018	US\$ 21,859,390.00

*Source: GHA progress report on projects as at 31 December 2018*

## 1.5 Methods of data collection

29. The team reviewed documents, interviewed key players in the construction of the selected roads and inspected the selected roads to take measurement and extract asphalt core samples for testing in the Laboratory. We applied these procedures to enable us triangulate our evidence that we considered necessary and appropriate to provide such assurance that our audit objectives are met.

### **1.5.1 Document review**

30. We reviewed documents on the planning and implementation of the three projects provided by GHA, Contractors, Consultants, Ministry of Roads and Highways and Ghana National Gas Company Limited. The documents were reviewed to give the audit team in-depth information on the selected projects and collection of primary evidence for the audit. Full details of documents reviewed is attached as Appendix 1.

### **1.5.2 Interviews**

31. We interviewed key officials of GHA, Contractors, Consultants, Ministry of Roads and Highways and Ghana National Gas Company Limited who were directly involved in the planning and implementation of the selected projects. The interviews enabled us corroborate or otherwise information from documents and site inspections. The interviews were conducted between 26 March and 31 July 2019. The full list of interviewees is attached as Appendix 2.

### **1.5.3 Field Inspection**

32. The audit team inspected the three roads to obtain a first-hand information on the status of the road project, the extent of works done, took measurements of road width, Schmidt hammer measurements of concrete strength, as well as asphalt cores for laboratory testing. The selection of locations to core was based on standards used by the American Society of Testing Materials (ASTM) for removal of compacted bituminous mixture (asphalt) for laboratory testing. Our sampling was done according to ASTM D3665 whilst the coring of the road was done in conformity to ASTM D5361.

33. We took seven asphalt core samples from the East Legon to Spintex road and 32 samples from the Eastern Corridor Lot 5 & 6 road. The team also

took random Schmidt hammer readings for concrete drains, culverts and bridges where they were accessible. Pictures of the field inspection are shown in Pictures 1 to 6.

**Picture 1: Coring of asphaltic concrete**



**Picture 1: Extracted Asphalt Core Sample**

**Picture 2: Coring of asphaltic concrete**



**Picture 4: Measuring Extracted Asphalt Core Sample**



**Picture 5: Taking Schmidt Hammer readings on concrete**



**Picture 6: Taking road measurement**



*Source: Audit team field coring and measuring of road, April - June 2019*

34. Our inspection enabled us to measure the width of the road at the point where the asphalt cores were taken to determine the width of carriageway and shoulder. We measured the total length of the road using the odometer of the trekking vehicle. These measurements were taken to enable the team compare with the specification in the drawings and contract documents so we could draw our conclusions. The details of the field inspection methodology are given in Appendix 3.

#### **1.5.4 Material Laboratory Tests**

35. These tests were conducted at the GHA Central Materials Laboratory and the results were compared to the design specifications in order to draw conclusions whether the materials used met specifications. Testing of the materials in GHA Laboratory was to enable the team as part of the audit, validate the capacity and existence of such a facility to GHA for their quality assurance purposes for road construction in Ghana. To limit the risk of



possible tampering of test results in the laboratory, the team was present at all steps of the processes supported by our technical adviser. Sample pictures of the laboratory testing are shown in Pictures 7 and 8 while the test results are presented in Appendix 4. We tested the asphalt sample for;

- i. Grading (i.e. aggregate size distribution)
- ii. Bitumen content (i.e. quantity of Bitumen in the asphaltic concrete).
- iii. Density (i.e. the degree of compactness of the asphaltic concrete) and
- iv. Air voids (i.e. air spaces in the asphaltic concrete)
- v. Physical thickness

**Picture 7: Size reduction of the asphalt core samples**



**Picture 8: Removal of air voids from loosened asphalt sample**



*Source: Laboratory testing of asphalt, April - June 2019*



## CHAPTER TWO

### 2.0 Description of the audit area

36. Roads have become an essential part of human endeavour and since the creation of automobile to replace donkeys and camels as means of transports, the need for well-networked and good roads to link communities have become a necessity. National targets for growth and poverty reduction also rely on an effective road transportation system. The inability to access services because roads are not motorable is an important element of social exclusion which defines poverty.
37. Providing accessibility to facilitate mobility and movement of goods and services throughout the country underpins national growth and reduces poverty, a key goal in the SDG for which Ghana has committed. In Ghana, 13.7% of the national GDP<sup>4</sup> is spent on infrastructure development, of which roads form a significant portion. Yet the maintenance of the same roads repeatedly within a short period after construction has become a drain on the country's budget and a concern to many.
38. Roads in Ghana are classified as Feeder Roads, Urban Roads or Highways depending on the location and use which in turn determines the design. Regardless of the category, these roads are needed to contribute to economic development. Good roads enable faster movement of people to the markets, hospitals, schools etc. Good roads have also been partly blamed for increase in road accidents. In recent times, statistics from the NRSC reveal a high number of deaths on our roads due to vehicular accidents. This nevertheless does

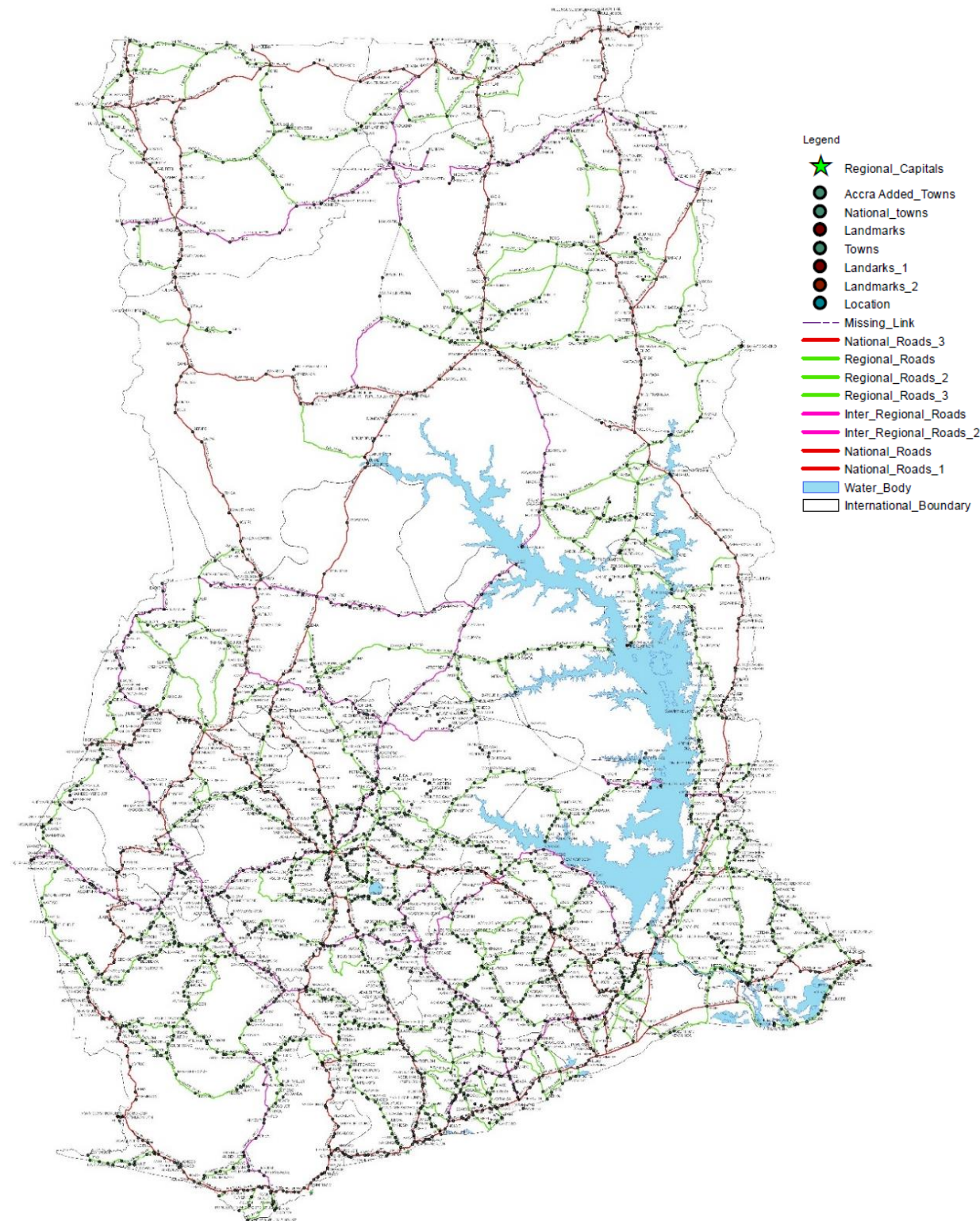
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<sup>4</sup> Provisional 2017 Annual Gross Domestic Product, Ghana Statistical Service (April 2018 edition)

not mean that Government should relent in improving upon the quality and length of roads in the country.

39. To ensure efficient administration of trunk roads in the country, the Ghana Highway Authority Decree 1974, (NRCD 298) was passed. This was later re-enacted by Parliament as Act 540 of 1997 to bring it in conformity with the constitution. According to Act 540, GHA is to design and supervise the construction of trunk roads and in some cases render consultancy services only to ensure contractors meet specification. The trunk road network is shown in Picture 9.

Picture 9: Trunk road network of Ghana



Source: Ghana Highway Authority

## **2.1 Overview of the selected road projects**

### **2.1.1 East Legon to Spintex Road Tunnel Project**

40. The Tunnel under the Accra-Tema Motorway linking East Legon and Spintex Road was constructed to ease daily traffic congestion along the Spintex to East Legon route because the crossing point was narrow as shown in Picture 10. The project comprised the construction of a 55m long and 8.0m wide Box Culvert serving as the Tunnel and 400m of approach roads to the tunnel. The Ministry of Roads and Highways tagged the project as an emergency project with the construction of the project beginning in August 2017 and with an expected completion date of 31 May 2018. Pictures 10 to 13 show sections of the project.

**Picture 10: Old Tunnel converted to pedestrian passage**      **Picture 11: Widened tunnel to allow movement for two lanes**



**Picture 12: New Spintex road entrance to Tunnel**      **Picture 13: East Legon entrance to Tunnel**



*Source: Audit team field inspection, April - June 2019*

### 2.1.2 Eastern Corridor Lot 5 & 6 Project

41. The Eastern Corridor Road is a 696km route from Tema to Kulungugu. The Eastern corridor Lot 5 and 6 Road Project was implemented to improve 209km out of the 696 km route connecting towns such as Oti, Bamanko, Bimbilla, Yendi, Gushiegu and Nakpanduri. The project was split into two lots with Lot 5 being 86km and Lot 6 being 123km. The objective of the project was to improve economic activities between the Volta and Northern Regions of Ghana through



improved accessibility and also facilitate movement of goods from Tema Port to Burkina Faso in a shorter distance. The project was funded with a loan from the Brazilian Government and a counter-part funding from the Government of Ghana. The construction of the road began in 2014 and was expected to be completed in 2016. Pictures 14 to 19 show sections of the project.

**Picture 14: Carriageway and Shoulder of section of Lot 5**



**Picture 15: bridge construction on Lot 5**



**Picture 16: Section of Lot 6 with crash barriers**



**Picture 17: Lot 6 Section showing carriageway**



**Picture 18: Pipe culvert constructed for Lot 6**      **Picture 19: Lay-by constructed for Lot 6**



*Source: Audit team field inspection, April - June 2019*

### **2.1.3 Oil and Gas Enclave Road Project**

42. In view of the generally poor condition of the road leading to the Atuabo Gas Plant, the Ministry of Energy and Petroleum arranged with the Jubilee Partners to solicit financial support to facilitate the improvement of the road network in the gas production zone. In 2014, Ghana National Gas Company Limited initiated and began implementation of the Oil and gas enclave road project from Atuabo to Alabokazo junction to facilitate the evacuation of gas in tankers from the LPG loading gantry. The project consisted of the construction of a new 6.2km road from the gantry post at Atuabo to Tikobo No. 1. It also included the realignment of 3.8km of existing road from Tikobo No. 1 to Alabokazo and construction of a new bridge over the Amazuri river. The 10km route chosen was such that the transportation of gas would bypass nearby villages. The estimated cost of the project was US\$ 22.0 million, it commenced in December 2014 and was substantially completed in May 2018. Pictures 20 to 23 show sections of the project.



**Picture 2: Start of project at Alabokazo**



**Picture 3: Alabokazo to Tikobu No.1**



**Picture 4: Stone pitching and trapezoidal drain**



**Picture 5: Bridge over Amzure River**



*Source: Audit team field inspection, April - June 2019*

## **2.2 Mandate of GHA**

43. Ghana Highway Authority is mandated by Ghana Highway Authority Act, 1997 (Act 540) to ensure effective and efficient management of trunk roads. The Act makes GHA the agency responsible for the administration, control, development and maintenance of trunk roads and related facilities, subject to the policies of the Ministry of Roads and Highways.



### **2.2.1 Vision statement**

44. The vision of the Ghana Highway Authority is being a world-class provider of safe road infrastructure.

### **2.2.2 Mission statement**

45. GHA provides Road Infrastructure Engineering and Management Services: project appraisal, feasibility studies and detailed design; contract preparation and administration; maintenance and operation; civil engineering materials prospecting and testing for roads, bridges and road safety facilities at best value – least cost to support the socio-economic development of Ghana and beyond.

## **2.3 Functions of GHA**

46. The functions of GHA as spelt out in the GHA Act relevant to the focus of the audit are:

- i. Plan, develop, maintain, protect and administer trunk roads and related road works;
- ii. Classify and lay down design standards on the different classes of trunk roads;
- iii. Undertake research or collaborate with any research Organization with a view to facilitating the Authority's planning, development and maintenance activities;
- iv. Maintain and preserve such records relating to its functions as it considers expedient;
- v. Maintain and update a list of designated trunk roads;

- vi. Carry out, on a permanent basis, such necessary engineering traffic and economic studies as it may consider necessary for the maintenance and improvement of the trunk road network;
- vii. Carry out either by its employees or through contractors with qualified consultants, location and design studies (including right-of-way and borrow pit requirements) necessary for programmed trunk road improvement or rehabilitation projects and prepare corresponding construction plans, specifications, cost estimates and other documents required for proper tendering of the programmed works;
- viii. Subject to existing enactments, tender, let and administer contracts for trunk road improvement and rehabilitation project and for trunk road maintenance activities for which contracting is considered by the Authority to be cost effective or otherwise advantageous;
- ix. Keep adequate records and operate a management information system which provides the managers with timely and accurate information on commitments and expenditure for works and services for which the managers are responsible;

## **2.4 Sources of funding**

47. Funding for road works are through the Ghana Road Fund, budgetary allocations from Government of Ghana (GoG) and loans disbursed through the Ministry of Finance (MoF). GHA is a road infrastructure and support agency responsible for the maintenance and development of trunk roads under the Ministry of Roads and Highways. Their budget is consolidated into the budget of the Ministry of Roads and Highways. The trend observed in Table 2 is that the disbursements are higher than approvals due arrears from previous years.

**Table 2: Budgeted and releases of funds for Road works from 2015-2018 (MR&H)**

Year	Total Planned budget, GH	Approved, GH	Disbursed, GH
2013	No data available	165,617,270.00	531,636,660.00
2014	2,087,381,700.00	747,030,416.00	1,223,681,240.00
2015	3,698,297,630.00	931,657,411.00	1,664,504,323.00
2016	5,279,909,020.00	624,624,197.00	3,084,015,085.92
2017	6,750,928,630.00	1,581,222,972.00	1,731,911,704.00
<b>Total</b>	<b>17,816,516,980.00*<sup>5</sup></b>	<b>4,050,152,266.00</b>	<b>8,235,749,012.92</b>

*Source: Extracted from Ministry of Roads and Highways Medium Term Expenditure Framework (2016 – 2018)*

48. A review of Table 2 show a trend observed where disbursements are higher than approved budget and our audit reveal were due to arrears from previous years which were not part of the budget submitted.

## **2.5 Key players and Stakeholders**

49. The Key Players for the audit are the Units and Departments that play a direct role in the planning and implementation of the project. The stakeholders to the audit are those institutions that support the Key Players in the execution of their roles. The list of Key Players and stakeholders of the audit are shown in Table 3 and detailed in Appendix 5.

**Table 3: Key Players and Stakeholders**

Key Players	Stakeholders
Ministry of Roads and Highways	Ministry of Finance
Ghana National Gas Company Limited	Ghana Road Fund
Ghana Highway Authority (All key departments)	Regional Coordinating Council

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\* Likely higher because of absence of figures

Engineer's Representative / Consultant	Lands Commission
Contractors	General public/communities
Survey department (Evaluation Unit)	Electricity, Water and other Service providers

*Source: Audit team review of project documents and correspondence*

## **2.6.0 System description**

50. The system description for the planning and implementation of road projects is shown in Figure 1 in Appendix 6.

## **CHAPTER THREE**

### **3.0 FINDINGS, CONCLUSIONS AND RECOMMENDATIONS**

#### **3.1.0 Introduction**

51. The Ghana Highway Authority (GHA) is responsible for the administration, control, development and maintenance of trunk roads and related facilities in the country. The audit of selected road projects examined the various processes of the project life cycle to determine whether in general, road works administered by GHA guaranteed value for money. To enable the team draw conclusion on this audit objective, we sought answers to our audit questions by analysing data gathered using our audit methodology detailed in paragraphs 11 to 20 and Appendices 3 and 4 of this report. Our findings, conclusions and recommendations on the East Legon to Spintex Road Tunnel, Eastern Corridor Road Lot 5&6 and the Oil and Gas Enclave Roads are presented in this chapter under the following headings:

- a. Planning for the road projects (Studies, design and budgeting)
- b. Procurement of contractor / consultant
- c. Project implementation
- d. Project closure and documentation

#### **3.2 Planning for road projects (studies, design and budgeting)**

52. Ensuring that project objectives are met depend greatly on how well planning was considered at the inception of the project. Planned road projects define the project objective by stating in broad outline what the project has to achieve and how it is to be operationalised including scope, procurement methods, time and

financing options. When planning is well undertaken, it allows a more detailed look at project resource requirements and will include feasibility studies, tender plans and construction plans. Feasibility studies in particular will provide information to determine appropriate design solutions, timelines and resource needs for funding.

53. We reviewed the Roads project planning process carried out by GHA on three selected roads by focusing on how feasibility studies were carried out to support project designs and estimation. We also reviewed the strategic and annual plans of GHA to ascertain whether these selected projects were captured in their long to medium term strategy.

### **3.2.1 Feasibility Studies**

54. Section 3 (1) (g) of Ghana Highway Authority Act, 1997, Act 540 mandates Ghana Highway Authority to carry out, on a permanent basis, such necessary engineering traffic and economic studies as it may consider necessary for the maintenance and improvement of the trunk road network. Standard industry practice requires GHA to carry out a feasibility study to assess the financial and technical viability of any project and propose preliminary designs prior to the implementation of such projects. The feasibility study and design provide information along the road corridor necessary for detailed design and costing of the project.
55. The studies also highlight current and projected traffic, surface and subsurface soil conditions, the extent of relocation of utilities and compensation to Project Affected Persons (PAPs) along the proposed route. This provides necessary baseline information for decision making as to whether to proceed to implement a project or not, the options available and a preliminary estimate of the cost of the project. Feasibility studies, documented in Feasibility reports are also a pre-

requisite to assess Donor funds for road projects and hence GHA is obliged to produce feasibility reports for such projects.

56. We reviewed the project inception documents and found that GHA adopted a Design and Build (FIDIC Yellow Book) approach for the implementation of the three projects. This approach places the responsibility of pre-contract feasibility and design on the contractor, as well as the post contract construction. However, the client (GHA) is given the right to review and give approval for commencement.

57. The responsibility to review and give approval in such arrangement puts a burden on GHA and does not absolve it from any blame even though the conditions of contract places the risk for pre and post contract on the contractor. To enable an effective and timely review under such arrangements, GHA needs to have a database of studies and survey reports on the roads earmarked for development in the country.

58. We noted through our interviews that GHA has no feasibility and survey information reports that can readily be assessed and used for project review as in the case of the three projects. In the given instances, the review process is not effective because data on the roads which should have been gathered and maintained by GHA are not available to make any meaningful interrogation of the Contractor's presented information.

59. We found that GHA has a Survey and Design Division under its Planning Department with the compliment of staff, equipped with many years of experience and knowledge to carry out surveys and feasibility studies to develop such a database. However, we noted that the Division had not been able to compile such data to aid their reviews. Our interviews and documents reviews reveal that there had been funding challenges through budgetary allocation from

GoG to support the Survey and Design Division undertake feasibility exercises of roads for the purpose of compiling data.

60. We found that the inability to support the review process with in-house information rather than the contractor's gathered data resulted in some delays in construction time and variations which were necessary but not foreseen. For example;

- with the East Legon Tunnel we noted that the contractors were invited to the project site and tasked by MRH to provide estimates for construction without preliminary information for design and construction. When the project was completed and opened to traffic, the problem of congestion was not solved because the traffic count and study that should have been used to determine the design was not available thereby requiring a variation.
- GHA (through ACON) reviewed and approved the construction of the Eastern Corridor Road when they did not have a complete assessment of utilities to be relocated and for compensation to be paid to PAPs. Consequently, in the given instance, the projected scope had to be reduced to absorb the cost of relocation and compensation so that the project cost remains unchanged
- GHA reviewed and approved of the Oil and Gas enclave roads under the agreed arrangement of design and build. During construction, the soil condition at some portions of the road needed to be re-enforced because it was swampy, thus extending the project completion time and cost.

## **Conclusion**

61. The absence of GHA compiled feasibility data on roads to aid in reviews of designs presented by contractors under the given arrangement was not helpful in interrogating the contractors design. Consequently, site conditions which



should have been identified were not, resulting in variations which affected project scope, schedule and cost during implementation. The GHA strategic plan were broadly defined with goals and objectives that did not spell out any specific area identified for development.

## **Recommendation**

62. Our review of the planning process under Contractor Design and built arrangement show that the review process of design proposals submitted by contractors by GHA is critical for a successful and effective implementation. However, the lack of support to the Survey and Design Division to compile data that aid in review remain a challenge.

63. To enable GHA review data provided by contractors engaged in design and build contracts, we recommend that GHA should:

- i. draw a plan and support the Survey and Design Division to prepare feasibility studies and compile data to cover roads earmarked to be developed in their strategic plans.
- ii. plan for future projects to ensure that all relevant information needed for the project to take off, as per Section 3 (1) (g) of Act 540 are available in the form of a feasibility study report.

### **3.2.2 Project Designs**

64. Section 3 (1) (i) of Ghana Highway Authority Act, 1997, Act 540 mandates Ghana Highway Authority through its employees or contractors with qualified consultants to carry out location and design studies (including right-of-way and borrow pit requirements) necessary for programmed trunk road improvement or rehabilitation projects and prepare corresponding construction plans,

specifications, cost estimates and other documents required for proper tendering of the programmed works.

65. We reviewed project documents and found that, there were preliminary designs and GHA reviewed the designs for the three road projects.
66. For the East Legon – Spintex tunnel project, GHA approved initial drawings from the contractor M/S Sonitra which comprised the tunnel and the approach roads from the existing road to the tunnel. These designs were later reviewed during implementation to include slip roads to and from the North end of the tunnel, improve the approach roads and increase its length from 400m to 700m.
67. The Eastern Corridor Lot 5 & 6 road project was designed and constructed by Andrade Gutierrez Engenharia S.A and Constructora Norberto Odebrecht in a joint venture. The Employer's requirement was for the contractor to come up with Preliminary Design, Advance Design, Detailed Design and Construction Drawings for the project.
68. GHA wrote to the contractor on 26 October 2011 and presented the employer's requirement to the contractor to enable him prepare adequately his design proposals and BoQ for executing the works. The contractor provided Topographic Survey, Traffic Studies, Geotechnical and Material Studies to come up with Geometric and Drainage Designs. The preliminary design was submitted in April 2014, Advance and Detail Design documents were submitted in July 2016. The documents submitted met the Employer's requirement.
69. The road designs for the Eastern Corridor Lot 5 & 6 were reviewed by Associated Consultants (ACON) prior to approval by GHA. ACON's review showed that the designs submitted by the contractor fell short of the minimum design requirements (GHA Design manual 1991) specified in the Employer's

requirement such as topographic surveys, discrepancies in road length and details on alignment cross-sections. Hence GHA through ACON asked the Contractor to amend the designs to conform to this standard. The contractor modified the designs to suit GHA standards and resubmitted for approval. The design contained estimates and detailed drawings for the proposed road project. We noted that the employer's requirement to the contractor did not include data on relocation of utilities and compensation to PAPs and hence the contractor did not provide information and estimates for these.

70. The Oil and Gas Enclave road project was designed and constructed by the contractor M/S CHICO. The contractor prepared typical designs and drawings for the carriage way and a 60m span bridge, for GHA's approval prior to award of the contract. During implementation, when actual site conditions were known, M/S CHICO prepared detailed designs and drawings in batches which GHA reviewed and approved as construction progressed.

## **Conclusion**

71. The three projects had preliminary designs which were not detailed enough but GHA reviewed and approved for the projects to commence. However, detailed designs were provided during implementation, and these resulted in significant changes to the original project scope.

## **72. RECOMMENDATION**

The use of preliminary designs to commence a project has proved unhelpful for GHA project management. To ensure efficient management of all projects we recommend that GHA should ensure that:

1. detail drawings are made available before projects are started.

2. Approval should not be given until significant detail drawing are made available.

### 3.2.3 Budgeting

73. Funding is key in any construction project. The smooth running of projects requires cashflow to the contractor in order for him to meet his costs. The duty of sourcing for funds for road projects rests with the Ministry of Roads and Highways (Employer) and it is critical that prior to award of contract for any road project the Ministry identify a reliable source of funding. We expect GHA to develop estimates for budgeting purposes to enable the Ministry secure adequate funding to meet all planned payment schedules during implementation of projects.

74. For the three projects, we noted that GHA obtained initial estimates based on preliminary designs and drawings. Table 4 shows the funding source, initial estimates, contract sums and the variances for the three projects. The initial estimates for the projects were established while the designs had not been finalised. Hence, the full nature and extent of works were not known necessitating the use of provisional sums.

**Table 4 Funding source and contract sums for the three projects**

Project	Source of funding	Initial Estimate	Contract Sum	Variance (%)
East Legon - Spintex Tunnel	GoG/Road Fund	\$14,815,261.46	\$14,815,261.46	
Eastern corridor Lot 5 & 6	Brazilian Development Bank and Banco do Brazil	\$290,642,000.00	\$290,642,200.00	0.00007

Oil and gas enclave roads	GoG/GNPC	\$22,581,246.08	\$21,859,390.00	(3.20)
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*Source: Audit team review of Project Documents*

75. From Table 4, we noted that for the Oil and Gas Enclave road, the contract sum was 3.2% below the initial estimate. For the Eastern Corridor Lot 5 &6 and East Legon-Spintex Tunnel, there were no differences between the initial estimates and the contract sums. For the East Legon to Spintex Road Tunnel and the Oil and Gas Enclave roads, the estimates were those provided by the contractors and used by the Ministry as the budget for the projects. GHA prepared the estimates for the Eastern Corridor Lot 5 & 6, which was used as basis for the loan amount for the project. Thus, these amounts became the contract sums.

76. The Ministry of Roads and Highways identified the sources of funding for the East Legon to Spintex Road tunnel and the Eastern Corridor Lot 5 & 6 projects to be Road Fund and a commercial loan from Brazil respectively. For the Eastern Corridor Lot 5 & 6 Project, we noted that the Government of Ghana went into a loan agreement with Banco Do Brazil and Brazilian Development Bank (BNDES) to fund the project. Under the agreement, GoG was to provide 16.67% (US \$48,451,508.00) as counterpart funding for the project and the two Brazilian banks were to provide 83.33% (US \$242,190,692.00). The release of this amount from the two Brazilian banks was pre-conditioned on GoG paying its part of any payment obligation that arose.

77. For the Oil and Gas Enclave road, the Project Coordinator from Ghana National Gas Company Limited (GNGC) stated that the Ministry of Energy and Petroleum had an agreement with the Ghana National Petroleum Corporation (GNPC) for GNPC to pay for the project. The estimated cost provided by the contractor used for budgeting is as stated in Table 4.

## Conclusion

78. GHA provided estimates for the three projects to serve as budget for the Ministry of Roads and Highways in sourcing for funds for the projects. The estimates provided were based on preliminary designs and provisional sums and did not represent the true cost of the projects.
79. Where the estimates for projects are not adequately determined, and are based on provisional sums, the extent and scope of work are arbitrarily varied because there is no ceiling on expenditure to guard against cost overruns. As we have elaborated under 3.4 (Project implementation) variations that were not budgeted for affected the completion time of the project and increased the project budget beyond 50% in some instances.

## Recommendations

80. Provisional estimates based on detail drawings provide decision makers a false idea to source and commit funds. We noted that for the projects in review, estimates were made from preliminary drawings and detail drawing were provided as and when during implementation. To improve upon the budgetary process
81. we recommend that GHA should;
- vi. prepare estimates based on detailed rather than preliminary designs to avoid arbitrary variations and to promote transparency in the process.
  - vii. ensure that complete designs and drawings are made available for any project it intends to implement, with its complementing bill of quantities prior to tendering, and

- viii. despite the limited data available in-house to aid review, constitute a technical team to thoroughly review **all** designs and drawings submitted by contractors to make sure that they reflect site conditions and the envisaged project to be implemented without rush.

### **3.3 Procurement of Consultants/contractors**

82. The Public Procurement Act, 2003, Act 663, (Part IV and V) provides guidelines and directions for procuring the services of contractors and consultants. Schedule 3 of the Act provides thresholds that procuring entities respect when engaging in procurement activities. The Act provides uniform procedures for the procurement of goods, works and services to secure a judicious, economic and efficient use of state resources and to ensure that public procurement is fair, transparent and non-discriminatory.

#### **3.3.1 Procurement of the East Legon to Spintex Road Tunnel**

83. Section 38 of the Public Procurement Act 2003 (Act 663) allows restricted tendering subject to the approval of Public Procurement Authority if works are available only from a limited number of contractors or if the time and cost required to examine and evaluate a large number of tenders is disproportionate to the value of the works. Section 39 of the PPA Act also states that in carrying out Restrictive tendering, the entity is required to invite in a non-discriminately manner contractors who can execute the work and publish in the public procurement bulletin notice of the selective tendering award.

84. Our review of correspondence and evaluation report on the East Legon to Spintex Road Tunnel Project showed that GHA classified the project as an emergency and adopted the restricted tendering method to procure the works. GHA could not provide the audit team its justification to the PPA requesting to use restrictive tendering to procure the works and PPA's approval for review.

85. From the evaluation report, GHA invited five contractors through letters dated 29 October and 14 November 2014, to inspect the project site and submit technical and financial proposals. The authority gave the firms three weeks to submit their proposals for consideration. The companies were,

- i. Messrs China water and Electrical Engineering Corporation Ltd
- ii. Messrs Ussuya Ghana Ltd
- iii. Messrs Sonitra Ltd
- iv. Messrs China Railway No. 5 Engineering Group Company Ltd
- v. Messrs Amandi Holdings Ltd

86. Three out of the five companies submitted their proposals for consideration. A three-member evaluation panel was constituted to evaluate the proposals and make recommendations. The evaluation report was completed in January 2016, thus a year after GHA invited the contractors to inspect the site in order to prepare bids. The report contained an assessment and scoring of the technical proposals which were submitted and the outcome is presented in Table 5.



**Table 5: Outcome of the evaluation of Technical proposals**

No.	Contractors	Items		Total  (Max, Marks100)
		Adequacy of the proposed technical solution (Max. Marks 60)	Technical approach and methodology (Max. Marks 40)	
1.	China Railway No. 5 Engineering Group Company Limited	49	31	80
2.	Sonitra Limited	55	35	90
3.	Ussuya Ghana Limited	45	25	70

*Source: Audit review of Tender Evaluation Report dated January 2016*

87. After the Technical Evaluation, all three contractors exceeded the 50-pass mark set by GHA and were invited to witness the opening of their financial proposals on 19 December 2015. To ensure that the financial proposals submitted by the contractors were feasible, the evaluation panel compared the financial and technical proposals to determine whether all personnel and reimbursable cost has been taken care of in the financial proposals. A summary of the financial evaluation scores are presented in Table 6.

**Table 6: Summary of Financial Evaluation Scores**

No.	Name of contractor	Financial proposal (GH¢ )	Scores	Ranking
1	Sonitra Limited	11,255,951.67	100.00	1
2	China Railway No. 5 Engineering Group Company Limited	13,448,240.61	83.70	2
3	Ussuya Ghana Limited	21,297,818.94	52.85	3

*Source: Audit team review of Tender Evaluation Report dated January 2016*

88. Based on the outcome of the technical and financial evaluation, the panel recommended Messrs Sonitra Limited as the most qualified to undertake the assignment at an evaluated tender price of GH¢ 11,255,951.67. The panel however recommended that Messrs Sonitra be invited for negotiations on their evaluated price exclusive of taxes, Specified Provisional Sums and Contingency to provide the design and construct the East Legon to Spintex Road Tunnel.

89. Following from the recommendation of the evaluation panel, GHA invited Messrs Sonitra limited for negotiations which resulted in the following:

- i. Increase in length of the tunnel to 55m
- ii. Update of unit rates of all BoQ items
- iii. Include a specified Provisional Sum for street lighting and relocation works
- iv. Make provision for 15% physical contingency
- v. Submit a revised and complete BoQ to take into account of the increased scope of works

90. Based on the above directives, Messrs Sonitra Limited submitted a revised Bill of Quantities with the estimated cost of works at GH¢ 17, 758,312.99. After further negotiations, the contractor agreed to carry out the works at GH¢ 14,815,261.46, a reduction of 19.86% from the estimated GH¢ 17, 758,312.99.
91. We noted through a review of the contract document that, GHA after a successful evaluation wrote a letter to the Ministry dated 10 May 2017 requesting approval to award the contract to Messrs Sonitra Limited. The Ministry through a letter dated 10 May 2017 granted the approval and consequently, GHA wrote an acceptance letter to the contractor on 7 June 2017. In a letter dated 7 June 2017, Sonitra Limited acknowledge receipt of the acceptance letter. The contract was signed by a representative of the Ministry of Roads and Highways on behalf of Government of the Republic of Ghana and the Managing Director of Sonitra Limited on the 1 August 2017 at a contract sum of GH¢ 14,815,261.46. A representative of Sonitra witnessed for the contractor whilst the Chief Executive Officer of GHA witnessed for the Ministry. The duration for the contract was 10 calendar months. Sonitra Limited submitted a Performance Bond from Vanguard Assurance Company to the tune of GH¢ 4, 444,580.00 which was 30% of the contract sum in line with Sub-clause 4.2 of the Particular Conditions of Contract.

### **3.3.2 Procurement of the Eastern Corridor Lot 5 & 6 Project**

92. Section 40 (1) (a-d) of the Public Procurement Act 2003 (Act 663) allows the Single/Sole method when there is exclusivity, urgency, emergency, continuity and compatibility subject to the approval of the Public Procurement Authority. For the Eastern Corridor Lot 5 & 6 road project, GHA used Single/Sole Sourcing to procure Messrs Andrade Gutierrez S.A and Odebrecht S.A as a joint venture.

93. We noted from review of the contract document, correspondence and progress reports that funds for the project were secured from a loan agreement under which the joint venture contractors (made up of Andrade Gutierrez S.A and Odebrecht S.A) were named as the contractor to execute the project. GHA provided the joint venture contractor with an Employer's Requirement to guide the contractor's preparation of proposals for the work. The contractor submitted Technical and Financial Proposals for the road on 29 September 2011. GHA reviewed and accepted the technical and financial proposals.
94. Following from the acceptance of the Technical and Financial Proposals, GHA wrote to PPA on 27 February 2012 to request for approval to sole source Messrs Andrade Gutierrez S.A and Odebrecht S.A. In a letter dated 2 March 2012, PPA requested GHA to resubmit the request for approval, attaching clearance from Ministry of Finance, a copy of the loan agreement and a Parliamentary approval. GHA complied with the request after which PPA gave its approval for the sole sourcing of the contractor.
95. The resulting contract was signed between the Government of the Republic of Ghana (Ministry of Roads and Highways) and the joint venture on 29 July 2012 at a contract sum of US\$ 290,642,200.00 to construct the Eastern Corridor Road Lot 5 & 6 (209 km). The duration for the contract was 900 days (30 calendar months). The contractor submitted a performance security from Santander Bank to the tune of US\$14,532,110.00 being 5% of the contract sum covering a validity period from the commencement of construction to 70 days after the expiry of Defects Liability Period (01/05/2017). The value of the performance security was less than the 10% stipulated in Sub-Clause 4.2 of the particular conditions of contract.

### **3.3.3 Procurement of Consultant for Eastern Corridor Lot 5 & 6 Project**

96. Section 38 of the Public Procurement Act 2003 (Act 663) allows restricted tendering subject to the approval of Public Procurement Authority if services are available only from a limited number of consultants or if the time and cost required to examine and evaluate a large number of tenders is disproportionate to the value of the service. Section 39 of the PPA Act also states that in carrying out Restrictive tendering the entity is required to invite in a non-discriminately manner consultants who can provide the service and publish in the public procurement bulletin notice of the selective tendering award.

97. From review of correspondence we noted that GHA wrote to PPA on 28 November 2012 to request for a restrictive tendering to enable GHA expedite the procurement process of services of the supervising consultant since the contractor had commenced work. GHA submitted the names of 3 consultants which were Associated Consultants Limited, Bans Consult Limited and ABP Consult Limited for approval. GHA wrote to the Central Tender Review board on 27 August 2013 for concurrent approval of recommendation for award of contract to Messrs Associated Consultants, for the supervision of the road. GHA however could not provide the audit team with the evaluation report and approval from PPA for our verification.

### **3.3.4 Procurement of Contractor for the Oil & Gas Enclave Roads**

98. Section 38 of the Public Procurement Act 2003 (Act 663) allows restricted tendering subject to the approval of Public Procurement Authority if works are available only from a limited number of contractors or if the time and cost required to examine and evaluate a large number of tenders is disproportionate to the value of the work. Section 39 of the PPA Act also states that in carrying out Restrictive tendering the entity is required to invite in a non-discriminately

manner contractors who can execute the work and publish in the public procurement bulletin notice of the selective tendering award.

99. Our review of correspondence on the Oil and Gas Enclave roads showed that Ghana Gas Company Limited was in urgent need of a road to convey Liquified Petroleum Gas from its loading gantry at Atuabo to Alabokazo junction on the Agona-Elubo highway. Ghana Gas Company Limited indicated a deadline of 15 June 2014 to have the works completed:-

100. We noted that Ghana Gas Company Limited invited 3 road contractors to inspect the project corridor on 26 March 2014 and requested that the contractors submit the following details by the close of 27 March 2014:

- Indicative cost to construct a new bridge over the Amanzure River;
- indicative cost to construct the new bridge and the entire 10 km road (asphalt concrete)
- Duration to complete the bridge construction as well as the entire 10 km
- brief construction methodology with works programme that would meet the client's requirement

101. Ghana Gas Company Limited extended the submission date to 31 March 2014 after consultation with GHA. Two out of the three contractors submitted their bids as shown in Table 7.

**Table 7: Bids submitted and Engineer's estimate**

Item	Name of bidder	Bid price (Received)	Evaluated bid price	Rank	Completion period
1.	M/S China Henan International Cooperation Group Co. Ltd. (CHICO)	15,891,090.00	16,286,090.00	1 <sup>st</sup>	6 Months
2.	M/S China International Water & Electrical Cooperation (CIWEC)	19,487,073.65	16,444,549.54	2 <sup>nd</sup>	5 Months
3.	M/S Jiangxi Zhongmei Engineering Construction Co. Ltd	Nil	Nil	Nil	-
	Engineer's Estimate	-	16,769,590.00	-	8 Months

*Source: Audit review of project correspondence file*

102. We noted from correspondence that GHA selected M/S China Henan International Cooperation Group Co. Ltd. (CHICO) as the winning firm to implement the project based on the evaluated bid price. Neither GHA nor Ghana Gas Company Limited could provide the evaluation report that formed the basis for their selection of the winning contractor for our review.

103. The Ministry of Energy and Petroleum wrote to CHICO on 10 April 2014 to inform them of the Ministry's acceptance of their bid subject to further

procurement approval. The Ministry after using the restricted tendering approach to solicit for bids engaged the services of CHICO under a sole sourced procurement. The Minister for Energy and Petroleum informed the Minister for Roads and Highways in a letter dated 23 May 2014 that the Public Procurement Authority per letter referenced PPA/CEO/702/05/14 dated 13 May 2014 had granted approval for the sole sourcing of CHICO for the construction of the 10 km road along the gas pipeline corridor of the Oil and Gas enclave roads including the Amazure bridge at an estimated cost of GH¢ 59,490,195.70.

104. The Ministry of Energy sought approval from the Central Tender Review Board (CTRB) on 9 July 2014. The CTRB gave its concurrent approval on 25 July 2014 at a contract price of US\$ 21,859,390.00 which was equivalent to GH¢ 59,490,195.70. The Ministry gave approval to Ghana Gas Company Limited to sign the contract with CHICO on 22 August 2014.

105. GHA on 17 September 2014 wrote a letter of acceptance to CHICO stating the contract price of GH¢ 59,490,195.70 and a completion period of 8 calendar months. The contract was signed on 10 October 2014 by the Chief Executive Officer of Ghana Gas Company Limited as the Employer and witnessed by Senior Manager, Procurement at Ghana Gas Company Limited. The Managing Director of CHICO signed for the company and the Director of Engineering as his witness. CHICO submitted a performance security from Star Assurance Company Limited with a value of US\$ 6,557,817.00 (30% of contract price) to Ghana Gas Company Limited on 25 September 2014 and valid till the end of the contract. This was in line with Sub-Clause 4.2 of the particular conditions of contract.



## **Conclusion**

106. From our review of documents, GHA generally complied to the best as the law allowed in obtaining the services of the contractors for the three projects. However, the audit team could not validate the fairness and transparency of the processes due to the absence of evaluation reports and approval letters on the Eastern Corridor Road Project and the Oil and Gas Enclave Road Project. Sole sourcing and restricted tendering were used as a preferred method that does not necessarily guarantee Value for Money. All the consultants on the selected projects were sole sourced and two out of three of the contractors were sole source while the third was under restrictive tendering. The reliance on sole sourcing are partly due to the fact that the projects were not planned to allow for competitive sourcing based on the principles of Value for Money.

## **Recommendation**

107. To improve fairness and transparency in procurement of consultants and contractors we recommend that GHA should make use of competitive tendering by improving upon their planning process and produce all procurement documentation for consultants and contractors for review and validation.

### **3.4 Implementation of the road projects (managing scope, cost, time and ensuring project quality)**

108. Project implementation is the stage when the project team puts all the plans initiated to deliver the works for its intended use. During implementation, GHA is to ensure that processes are put in place to manage and control projects scope, schedules and to ensure project quality. A poorly managed implementation stage poses a risk to timely completion and adherence to project budget. We expect that GHA had planned to implement the projects using baseline schedules which

was to guide them track progress of the works, payments for work done and manage scope so as not to escalate project cost.

109. We reviewed the sources of variations that contributed to changes in scope and assessed whether the scope changes were avoidable, necessary, and how these changes impacted the project cost. We employed our audit methodology to review the processes for controlling project schedules and whether GHA put in appropriate steps to mitigate project delay. We also looked at the payment for works and the quality control and assurance systems employed to deliver the project to contract specifications.

110. The results of our assessment of the implementation of the selected road projects have been presented under the following headings:

- Scope management (Variations)
- Cost management (Payment for works)
- Time management (Completing the project on time) and
- Ensuring project Quality (Delivering the project to the specified quality)

### **3.4.1 Implementation of the East Legon to Spintex Road Tunnel project**

#### **3.4.1.1 Scope management (variations)**

111. Our review of project documents and correspondence showed that the initial scope of the construction of the Tunnel under the Accra-Tema Motorway to link East Legon and Spintex Road was a construction of 55m Box Culvert (Tunnel) and 400m approach roads amounting to GH¢ 14,815,261.46. The parameters of the initial scope of works for the Tunnel and Approach Roads are shown in Table 8.

**Table 8: Initial Parameters for project**

Parameters of the Tunnel	<ul style="list-style-type: none"><li>• Length of Tunnel - 55m</li><li>• Number of cells - Single</li><li>• Horizontal/Vertical Clearance - 8m/3.6m</li><li>• Top &amp; Base Slab Thickness - 0.7m</li><li>• Side Wall Thickness - 0.5m</li><li>• Length of Aprons - 7m</li></ul>
Parameters of the Approach Roads	<ul style="list-style-type: none"><li>• Total Length - 400m</li><li>• Pavement Thickness (750mm)<ul style="list-style-type: none"><li>○ Sub-Base - 250mm</li><li>○ Gravel-Base 200mm</li><li>○ Crushed-Rock Base - 200mm</li><li>○ Asphaltic Concrete - 100mm</li></ul></li></ul>

**Source: Contract Document for Construction of the East Legon to Spintex Tunnel**

112. We compared the works executed and the initial scope envisaged and found that additions were made to the initial scope during implementation. The additional works were to;

- Increase the length of approach roads from 400m to 700m (redesign of approach roads)

- Provide additional double-lane road with a length of 550m from Shiashi to American House direction
- Provide traffic signalization at Legon junction
- Provide a gantry post

113. Our review of correspondence showed that the additions became necessary after a traffic survey was carried out by GHA when the Tunnel was initially opened to traffic. At the time the road was opened to traffic, the traffic congestion for which reason the road was constructed had not changed and this necessitated a redesign of the approaches to remedy the situation. Ideally, traffic surveys are to be carried out during feasibility studies, which then forms basis for design, estimation and securing of funds for implementation. However, in the case of the construction of the East Legon to Spintex Road Tunnel, we noted that GHA did not have traffic data and future projections of traffic on the road corridor as stated in the finding on feasibility studies hence resulting in a variation of GH¢ 10,504,982.66.

114. The implementation of the variation of GH¢ 10,504,982.66 which was 70% of the original contract sum of 14,815,268.46 required approval from the Ministry of Roads and Highways and the Central Tender Review Board (CTRB) in accordance with Section 87 (1) of the PPA Act 663. We noted that contrary to this requirement, GHA did not obtain approval before implementation. Sonitra Limited in May 2018 started implementing the additions to the original scope before GHA secured the required approvals from the Ministry of Roads and Highways retrospectively on 6 June 2018 and the Central Tender Review Committee on 8 August 2018.

### **3.4.1.2 Cost management (Payment for works)**

115. Sub Clause 14.7 (b) of the General Conditions of contract stipulates that the Employer shall pay the amount certified in each Interim Payment Certificate (IPC) within 56 days after the engineer receives the statement and supporting documents. Regular payments of IPCs on time ensures adequate cashflow available to the contractor in order for him to meet his costs.
116. Also, Sub Clause 14.8 (a and b) of the General Conditions of contract stipulates that if the contractor does not receive payment in accordance with sub clause 14.7 (payment), the contractor shall be entitled to receiving financing charges compounded monthly on the amount unpaid during the period of delay. The charges are to be calculated at an annual rate of three percentage points above the discount rate of the central bank in the country of the currency of payment and shall be paid in such currency.
117. We noted through review of project files that, the contractor through the Resident Engineer raised five IPCs at the time of the audit. A payment report from the Ghana Road Fund Secretariat dated 4 April 2019 indicates that two (IPC 1&2) out of the five IPCs raised have been honoured totalling GH¢ 14,400,678.93. We noted that the amount on the two certificates exhausted the project budget of GH¢ 14,815,261.45. When IPC 3,4 and 5 were raised to pay for additional works beyond the initial contract sum, funds had to be sourced to pay for the works. Interviews with officials of GHA confirmed that the additional works were not budgeted for. Details of the certificates raised and those honoured are presented in Table 9.

**Table 9: Details of Interim Payment Certificates raised as of 30 June 2019**

IPC No.	Date certificate was raised	Amount certified (GH¢)	Amount paid (GH¢)	Date certificate was honoured
1.	10 November 2017	6,014,244.30	6,014,244.30	17 January 2018
2.	20 February 2018	8,386,434.00	8,386,434.63	12 April 2018
3.	12 June 2018	5,655,838.37	0	- (not yet paid)
4.	13 September 2018	5,287,954.19	0	- (not yet paid)
5.	19 February 2019	2,781,032.00	0	- (not yet paid)

*Source: Interim Payment Certificates and payment report from Ghana Road Fund Secretariat*

118. Our review shows that only IPC 2 was paid within the stipulated 56 days and IPC 1 had delayed by 12 days at the time of payment. We observed that these two certificates were honoured relatively quick because there was money available . IPCs 3,4 and 5 were still outstanding and had delayed by 327, 234 and 75 days respectively at the time of the audit (June 2019). From our analysis, these delays were partly due to the period for processing IPCs going beyond the stipulated 56 days and Road Fund failing to make payments promptly after the processing had been done. We observed that because these variations were not identified and captured in the project budget for which reason funds were not made available, Road Fund found it difficult to honour such certificates as prompt as within the time allowed.

119. We reviewed data on the processing time and the details of delays beyond 56 days is presented in Table 10.

**Table 10: Details of delays beyond 56 days**

IPC No.	No. of days spent			Total No. of days used for processing (P=a+b+c)	Delay beyond 56 days		
	Resident Engineer (a)	Regional Coordinating Council (b)	GHA (c)		Delay due to processing (D=P-56)	Delay due to non-payment (X) as at the time of audit	Total delay (D+X)
1	-	-	2	-	-	12	12
3	-	-	6	61	5	322	327
4	27	76	3	106	50	184	234
5	22	54	12	88	32	43	75

*Source: Audit Team Review of IPCs*

120. We further noted that the processing of the IPC starts from site where the Resident Engineer (RE) vets and validates the contractor's claims. The Regional Coordinating Council (RCC) endorsed the IPCs and forwarded it to GHA head office for final scrutiny before payments were made to the Contractor. The actual examination of the IPC is done by the RE on site and crosschecked at GHA head office.

121. We examined the endorsement dates on IPCs 4 and 5 and found that it took between 54 and 76 days for the IPCs to move from the Regional Coordinating Council to the Director of Quantity Survey at GHA. We interviewed the schedule officers at the RCC who explained that when the certificates arrive at the RCC, it is taken to the records department and logged before being forwarded to the Regional Economic Planning Officer. To vet the IPC, the RCC constitutes a team to inspect the project if they were not part of the site inspection relating to the IPC to be paid. This is done to satisfy themselves that the amount of works being

paid for is commensurate with the works done on site. Once RRC has ascertained the actual work done, the schedule officers (Economic Planning Officer, Coordinating Director and Regional Minister) take turns to endorse the certificate which usually depend on their availability and also contributing to delays.

122. According to management of GHA, there are instances when the 56 days stipulated in clause 14.7 will elapse before the IPCs gets to GHA head office. We found that delays in honouring certificates beyond the stipulated time resulted in Contractors applying the clause on delayed payment thereby needlessly increasing the project cost. In the given instance, if the Contractor were to apply Clause 14.7 (b) of the General Conditions of Contract, Government of Ghana will pay an interest amount of GH¢ 1,630,481.65 in respect of IPCs 1, 3,4 and 5 as per our calculation as at time of the audit (June 2019).

123. We noted that GHA did not have institutional policies on how long IPCs should stay at each processing point before the stipulated 56 elapses. As a result, there were undue delays in processing the IPCs for payment. Our assessment of the steps required to clear a certificate before payment is made which has been instituted as a control regimes is about nine levels. The number of levels is cumbersome and contributing to a bureaucracy thereby delaying the payment process.

#### **3.4.1.3 Time management (Completing the works on time)**

124. According to the contract, the commencement date for the project was 1 August 2017 and scheduled to be completed by 31 May 2018 (10 calendar months). We noted from correspondence and progress reports that the project commenced as scheduled and was substantially completed on 23April 2018.



During the Defects Liability Period, GHA asked the contractor to carry out additional works which necessitated an extension of time of the project.

125. The extension of time was brought up by a variation order No. 1 which was to solve congestion at the approach roads after the project was opened to traffic during the substantial completion. The contractor in accordance with Sub-clause 8.4 of the General Conditions of Contract wrote to GHA on 16 August 2018 asking for an extension of six-months to enable him execute the additional works. The contractor finished the works in four-months instead of the six-months he requested without receiving written approval from the Employer. We noted through correspondence that, GHA wrote to the Ministry of Roads and Highways on 17 January 2019 asking for approval to grant the six-months extension of time when the contractor had already completed the additional works and handed over the project.

126. The Resident Engineer explained to the audit team that the contractor accelerated the works by working overtime and so was entitled to the six-month extension.

#### **3.4.1.4 Delivering the project to the specified quality**

127. Section 8 of the General Conditions of Contract provides both standard and special specifications which the Contractor is to adhere to. Section 2 of the Specifications spells out the tests on materials and the required level of workmanship required for the project. The tests include:

- Grading,
- Compaction,
- Concrete tests, and

- Asphalt tests

128. For the East Legon to Spintex Road Tunnel, the specifications for concrete strength for the underpass and carriageway slab were C40/20<sup>6</sup> and that of the drains were C25/20. For the road, the carriageway width was 7.3m and shoulder width were 1.0m in each direction. The structure of the pavement for the road was 750mm, made up of 50mm wearing course, 50mm binder course, 200mm gravel base, 200mm crushed rock base and 250mm sub-base.

129. The audit team inspected the works carried out by the contractor and measured the length of the road and width of the carriageway/shoulders in the presence of the Contractor's and GHA's representatives. We also took Schmidt hammer readings of concrete structures. The team extracted seven asphalt core samples and measured the thicknesses of the asphalt concrete layer with a tape measure. These measurements were taken in order to compare our readings with the contract specifications and to note any deviations. Our observations from the field inspection is shown in Tables 11 for Schmidt Hammer Readings, Table 12 for road measurements and Figure 2 for thickness of the extracted asphalt cores.

**Table 11: The Tunnel under the Accra-Tema Motorway to link East Legon and Spintex project Schmidt Hammer Readings**

Location of Structure/Chainage	Type of Structure	Schmidt Hammer readings (N/mm <sup>2</sup> )	Specified Strength (N/mm <sup>2</sup> )	Remarks
LHS Phase 1	Box Culvert	54	40	Met specification
LHS Phase 2	Box Culvert	48	40	Met specification

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<sup>6</sup> Concrete grade/ strength class C40/20 with a minimum cylinder strength of 40N/mm<sup>2</sup> and a minimum cube strength of 20N/mm<sup>2</sup>.

LHS Phase 3	Box Culvert	50	40	Met specification
RHS Phase 1	Box Culvert	45	40	Met specification
RHS Phase 2	Box Culvert	48	40	Met specification
RHS Phase 3	Box Culvert	42	40	Met specification
CH 0+700	U-Drain	29	25	Met specification
CH 1+300 (towards American house – east bound)	U-Drain	28	25	Met specification
CH 0+300 (towards Spintex-south bound)	U-Drain	40	25	Met specification

**Source: Audit Field Inspection Results. NB: LHS is left hand Side, RHS is Right Hand Side and CH is Chainage**

**Table 12: Road width results from audit inspection**

Chainage	Width of Road, as measured by audit team in meters	Width of road as specified in Contract in meters	Width of Shoulder as measured in meters (LHS)	Width of Shoulder as measured in meters (RHS)	Specified shoulder Width on both sides in meters	Remarks
1	7.40	7.3	1.00	0.85	1	Met specification
2	7.55	7.3	0.95	0.85	1	Met specification
3	7.45	7.3	1.00	0.86	1	Met specification
4	7.49	7.3	0.86	0.95	1	Met specification
5	7.51	7.3	0.93	0.83	1	Met specification
6	7.58	7.3	0.92	1.40	1	Met specification
7 (Y, RHS)	7.56	7.3	-	-	-	Met specification
8 (Y, LHS)	7.35	7.3	-	-	-	Met specification

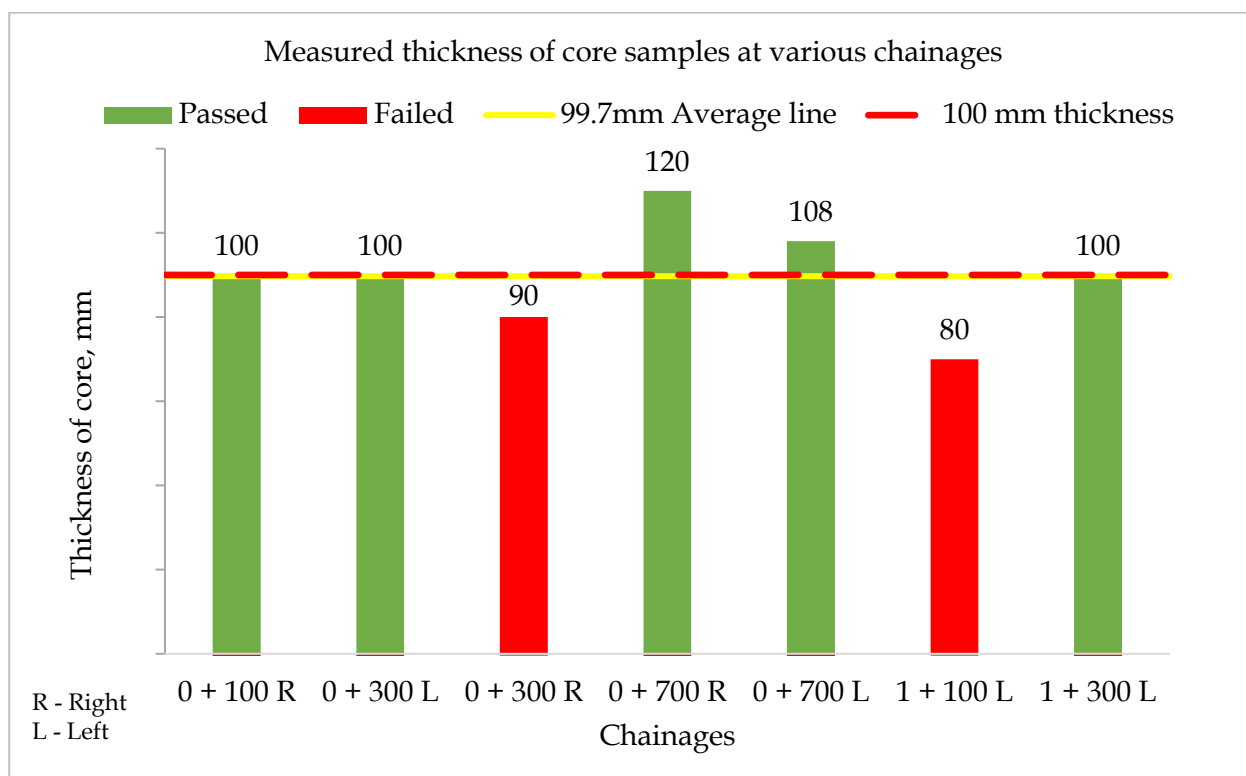
9 (Towards American House)	7.90	7.3	-	-	-	Met specification
10 (Towards Shiashie)	8.07	7.3	-	-	-	Met specification

**Source: Audit Field Inspection Results. NB: LHS is left hand Side, RHS is Right Hand Side**

130. Our analysis of data collected during field inspection presented in Tables 11 and 12 and attached as Appendix 7 and compared with the specification gives assurance that GHA through the Resident Engineer ensured that concrete strength and road widths specified in the contract were adhered to. We noted that the positioning of kerbs for the walkway which occupied portions of the shoulder of the road accounted for the 0.10m difference in the shoulder measurement less than one meter.

131. We measured the thickness of the core samples extracted in the field and compared with the specification design contained in the contract. Figure 2 shows a bar graph showing thickness at each chainage compared to the specified thickness of 100mm.

**Figure 1: Graph of asphalt core thickness measurements**



*Source: Audit team field measurement of thickness of asphalt cores (9 April 2019)*

132. Analysis of Figure 2, shows that five out of the seven readings of the core samples met the specified thickness of 100mm while the remaining two did not meet the specified thickness. The average thickness of the seven samples which is 99.7mm was satisfactory.

133. The samples were taken to the laboratory for testing to determine whether the constituents of the asphalt concrete met specifications. The samples were tested for the bulk density, air voids, bulk specific gravity, bitumen content and grading. The laboratory results obtained are shown in Table 13. The East Legon Tunnel road wearing course and binder course shows 21% and 20% grading outside specifications respectively and a relatively high average bulk density. The binder course recorded average thickness of 7.78mm above 50mm while the wearing course thickness averages 4.02mm less than the specified 50mm thickness which could have derogative effects on the road.

**Table 13: Laboratory test results obtained for the East Legon to Spintex Road Tunnel**

No.	Average Bulk density (gm/ml)	Average Air Voids (%)	Bulk Specific Gravity (gm/ml)	Asphalt Bitumen Content (%)	Grading	Average Core thickness (mm)
<b>Wearing course batch 1</b>	2.614	5.43	2.764	5.4	70% Within Specification	45.98
<b>Wearing course batch 2</b>	2.614	5.43	2.764	5.3	88% Within Specification	
<b>Binder course batch 1</b>	2.604	6.18	2.775	5.3	80% Within Specification	52.485
<b>Binder course batch 2</b>	2.25	8.465	2.458	5.6	80% Within Specification	

*Source: Audit Service Consultant's interpretation of laboratory test results on asphalt core samples*

134. We also noted that quality specifications for the specific components of asphalt were made with minimum and maximum limits for grading of aggregates. These are industry standards. Analysis of the graph of grading of aggregates attached as appendix 4 shows that 80% of the time, the graph representing the actuals grading of aggregates is more shifted to the lower limits than the upper limits while 20% of the aggregates fell outside the specification limits. We observed that these occurrences although within the specified limits, provide the Contractors the discretion to choose to be within the lower limits to maximise their profits.

### **3.4.2 Implementation of The Eastern Corridor Road Project (Lot 5 & 6)**

#### **3.4.2.1 Scope management and variations**

135. The scope of the Eastern Corridor road Project- Lot 5 & 6 comprised the construction of a 209.3km road connecting major towns in the Volta and Northern Regions. Lot 5 is 86km and covers the towns of Oti, Damanko, Bimbilla and Yendi while Lot 6 is 123.3km and covers Yendi, Gushiegu and Nakpanduri. From our review of the Employer's Requirement in the contract document, we noted that the contractor had to construct:

- a 15.3m wide road through Bimbilla, Gushiegu and Nakpanduri made up of a 7.3m carriageway, 1.5m sidewalks and 2.5m service lanes on the left- and right-hand sides;
- a 21.6m wide road through Yendi made up of a 14.6m dual carriageway, 3.0m median, 2.0m sidewalk on the left-hand and right-hand sides, and
- a 12.3m wide road through the rural areas made up of 7.3m carriageway with 2.0m wide asphaltic surface shoulder and 0.5m gravel surface shoulder on the left and right-hand sides.

136. The scope also included demolition and replacement of weak and damaged bridges and culverts, construction of drainage structures, slope protection, two rest stops, two service centers, two toll gates with traffic control devices and the provision of 12-bedroom accommodation for the supervising consultant.

137. We found that the length of the asphalted layer of the road to be constructed had reduced from 209.3km to 168km during implementation. In varying the project, GHA was to obtain approval from the employer, Ministry of Roads and

Highways for changes in the scope in the form of Variation Orders to be raised by the consultant before they are implemented.

138. We noted from correspondence that the consultant issued three Variation Orders (V.O) for which GHA sought approval from the Ministry of Roads and Highways. Variation Order 1 (US\$ 119,241.8) was issued to increase the Engineer's accommodation from 12 to 19 bedrooms and was approved on 3 May 2016. The works in V.O.1 were not done because there were no funds under the contract to pay for the additional works.

139. A Variation Order No. 2 (US\$ 133,737,680.45) was also issued to rescope the works after a detailed design of the project was completed and this was approved by the Ministry on 11 November 2016. The works were implemented by scaling down on the length of the road and other components of the project whose cost amounted to the variation. Another variation, V.O.3 comprising additions (US\$ 40,395,236.54) and omissions (US\$ 40,395,236.54) was issued by ACON on 23 August 2018 and approved by the Ministry on 31 October 2018. The net effect of these variations was to maintain a fixed contract sum at the expense of the length of the road and reduction of some facilities. This was because the Ministry took a decision to offset the additional cost due to extension of time and other works, by omitting some items from the original scope.

140. The composition of additions and omissions due to V.O.3 are as follows:

#### Additions

- General items due to extension of time
- Compensation
- Relocation of Service lines



- Haulage of Aggregates
- Dual-carriage in Bimbilla
- Second seal of surface dressing layer on road shoulder

#### *Omission*

- Engineer's Residential Accommodation
- Street Lights in Yendi
- All drainage works in the existing surface-dressed asphalt
- 50mm of asphaltic concrete beyond km 75+000 to km 98+000
- Bridge at km 99+139 in (Lot 6)
- Clearing and embankment work beyond km 98+000 to km 166+000 (Lot 6)
- Sub-base, pavement, longitudinal and transverse drainage, grassing, road markings and vertical signalling beyond km 98+000 to km 166+000 (Lot 6)

141. The audit team found that the variations which occurred were as a result of commencing the project with preliminary designs which formed the basis of arriving at the cost of the project which was used to source for the loan to execute the project. GHA did not have adequate data to inform a realistic design and estimate for the project prior to implementation. This has resulted in the reduction of the original length of the road from 209.3km to 168km when the full extent of the scope of the project was determined during construction.

### 3.4.2.2 Cost Management (Payment for works)

142. Sub Clause 14.7 (b) of the General Conditions of contract stipulates that the Employer shall pay the amount certified in each Interim Payment Certificate (IPC) within 56 days after the engineer receives the statement and supporting documents. Regular payments of IPCs on time ensures adequate cashflow available to the contractor in order for him to meet his costs. Sub Clause 16.1 of the Particular Conditions of contract also states that if the Employer fails to comply with Sub-Clause 14.7, the contractor may after giving not less than 21 days' notice to the Employer, suspend work unless and until the contractor has received the payment.
143. From the contract document, the Lender (Brazilian Government) was responsible for the payment of 83.33% of every IPC raised while the Employer (Ministry of Roads and Highways) representing Government of Ghana was responsible for 16.67% of every IPC raised. We reviewed IPCs, payment records and progress reports and found that the project was 76% completed. The Resident Engineer had certified 25 IPCs raised by the contractor amounting to US\$ 257,684,071.48 between August 2013 and March 2019. Out of this amount US\$ 252,122,447.32 being IPCs 1 to 23 and the Lender's portion of IPC 24 had been paid. The amount paid represents approximately 87% of the loan amount contracted to pay for the works. This means that 13% of the loan is available to complete about 24% of the remaining works.
144. We noted that the Employer and the Lender did not pay the contractor within the 56 days as stipulated under Sub Clause 14.7 (b) as shown in Table 14.

**Table 14: No of days beyond the stipulated 56 days for payment to the contractor as at June 2019**

IPC#	Amount (\$)	Submitted on	Due Date (56 Days)	Days Beyond 56 Days for GoG Component	Days Beyond 56 Days for Lender Component
2	7,373,117.46	03-Jul-14	28-Aug-14	123	361
3	8,956,992.47	25-Sep-14	20-Nov-14	70	277
4	4,590,755.25	20-Oct-14	25-Dec-14	239	215
5	4,120,477.75	26-Nov-14	21-Jan-15	212	358
6	4,361,081.33	05-Feb-15	02-Apr-15	762	160
7	7,846,565.58	28-Feb-15	25-Apr-15	739	264
8	9,783,829.72	01-Apr-15	27-May-15	707	350
9	9,370,204.28	28-Apr-15	23-Jun-15	680	205
10	5,439,497.43	31-May-15	26-Jul-15	647	172
11	13,187,488.74	03-Aug-15	28-Sep-15	583	382
12	7,053,833.39	31-Aug-15	26-Oct-15	555	354
13	13,065,528.67	12-Oct-15	07-Dec-15	513	312
14	15,439,417.39	30-Oct-15	25-Dec-15	495	294
15	12,230,568.87	30-Nov-15	25-Jan-16	464	263
16	5,694,832.38	22-Dec-15	16-Feb-16	422	241
17	5,056,825.76	31-Jan-16	27-Mar-16	402	201
18	5,577,998.45	29-Feb-16	25-Apr-16	373	172
19	7,522,871.07	24-Mar-16	19-Mar-16	349	148
20	4,789,278.20	29-Apr-16	24-Jun-16	846	112
21	4,561,805.05	27-Jun-16	22-Aug-16	787	542
22	10,393,785.24	16-Oct-17	11-Dec-17	287	504
23	9,015,547.32	15-Jan-18	12-Mar-18	196	413
24	22,304,621.48	21-May-18	16-July-18	142	310
25	1,818,708.20	20-Mar-19	15-May-19	7	7

*Source: Audit team review of IPCs and monthly project progress reports*

145. We found that it took the Lender between 70 and 846 days to effect payment while the Employer used between 112 and 542 days to settle its component of IPCs. As a result of the delay in payment, the contractor resorted to his rights under Sub Clause 16.1 to suspend the works.

#### 3.4.2.3 Time Management (Completing the works on time)

146. Section 7 Sub-clause 8.2 of the General Conditions of Contract requires the Contractor to complete all works stated in the contract, including passing of tests as required for the purpose of Taking-Over, within the Time for Completion.

147. We noted that the project commenced on 19 May 2014 and was scheduled for completion on 4 November 2016 (approximately 30 calendar months). However, the contractor suspended the works for approximately 12 months on three occasions between July 2016 and November 2018 due to non-payment of IPCs. The suspensions required that the employer granted the contractor extension of time of 21 months (18 months with cost of US \$ 23,762,165.35) to complete the works. At the time of the audit in May 2019, the project had not been completed. Table 15 shows the details of the suspension of works and extensions of time.

**Table 15: Details of suspension of works and extensions of time**

No.	Date of suspension	Date of resumption	Date extension of time was granted	Duration of suspension (months)	Extension of time granted (months)
1	18 July 2016	17 October 2016	20 October 2016	3	6 (Provisional)
2	15 February 2017	5 May 2017	6 September 2017	2.67	15 (12 with cost, 3 without cost)
3	15 May 2018	19 November 2018	Not Applicable	6	Nil

*Source: Audit team review of monthly project progress reports and correspondence*

148. Consequently, the project which should have been completed on 4 November 2016 has delayed for about three years beyond its expected completion date at the time of reporting. This has denied road users the benefits of a safe route from the south (Nkwanta) to the North (Nakpanduri).

#### **3.4.2.4 Delivering the project to the quality expected**

149. Section 8 of the General Conditions of Contract provides both standard and special specifications which the Contractor is to adhere to. Section 2 of the Specifications spells out the tests on materials and the required level of workmanship required for the project. The tests include:

- Grading,
- Compaction,
- Concrete tests, and
- Asphalt tests

150. The specifications for concrete strength for the bridges were C30/37<sup>7</sup>, the box culverts were C25/30 and the pipe culverts were C20/25. For the road, the carriageway width was 7.3m asphaltic surfacing with 2.0m wide single surface dressed shoulder and 0.5m gravel shoulder on the left and right-hand sides. The structure of the pavement for the road was 550 mm made up of 50mm wearing course, 250mm base and 250mm sub-base.

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<sup>7</sup> Concrete grade/ strength class C30/37 with a minimum cylinder strength of 30N/mm<sup>2</sup> and a minimum cube strength of 37N/mm<sup>2</sup>.

151. The audit team inspected the works carried out by the contractor and measured the width of the carriageway/shoulders in the presence of the Contractor's and GHA's representatives. We also took Schmidt hammer readings of concrete structures.

152. We observed that on Lot 5, the contractor had asphalted intermittent sections of the road leaving the remaining sections especially the stretches that pass through the towns unpaved. The Resident Engineer explained that the contractor skipped those places due to non-payment of compensation which prevented him from having access to the full right-of-way at those sections. For Lot 6, the contractor skipped the first 12 kilometers to start at chainages 12+000 to 75+000.

153. Our observations from the field inspection is shown in Table 15 for Schmidt Hammer Readings and Table 16 for road measurements.

**Table 16: Eastern Corridor Lot 5&6 project Schmidt Hammer Readings**

Location of Structure/Chainage	Type of Structure	Schmidt Hammer readings (N/mm <sup>2</sup> )	Specified Strength (N/mm <sup>2</sup> )	Remarks
12 + 210	Pipe Culvert (Head wall)	58	25	Met specification
49 + 311 RHS	Bridge (Abutment)	48	37	Met specification
49 + 311 LHS	Bridge (Abutment)	47	37	Met specification
65 + 986	Box Culvert	54	30	Met specification
77 + 920	Pipe Culvert	45	25	Met specification

Source: Audit Field Inspection Results, May 2019: NB: RHS right hand side LHS is left hand side

Table 17: Road width measurements from audit inspection (Lot 5)

Chainage	Width of Road, as measured by audit team in meters	Width of road as specified in contract in meters	Width of Shoulder as measured in meters (LHS)	Width of Shoulder as measured in meters (RHS)	Specified shoulder Width on both sides in meters	Remarks
39 + 000	7.45	7.3	2.55	2.50	2.00	Met specifications
42 + 000	7.47	7.3	2.46	2.77	2.00	Met specifications
46 + 350	7.53	7.3	2.35	2.82	2.00	Met specifications
52 + 425	7.45	7.3	2.83	2.70	2.00	Met specifications
55 + 425	7.50	7.3	2.60	2.50	2.00	Met specifications
58 + 605	7.50	7.3	2.50	2.80	2.00	Met specifications
66 + 325	7.50	7.3	2.35	2.40	2.00	Met specifications
69 + 900	7.39	7.3	2.47	2.54	2.00	Met specifications
72 + 900	7.44	7.3	2.50	2.46	2.00	Met specifications
79 + 420	7.51	7.3	2.44	2.35	2.00	Met specifications
82 + 420	7.45	7.3	2.45	2.40	2.00	Met specifications

Source: Audit Field Inspection Results, May 2019: NB: RHS right hand side LHS is left hand side.

**Table 18: Road width results from audit inspection (Lot 6)**

Chainage	Width of Road, as measured by audit team in meters	Width of road as specified in contract in meters	Width of Shoulder as measured in meters (LHS)	Width of Shoulder as measured in meters (RHS)	Specified shoulder Width on both sides in meters	Remarks
12 + 210	7.65	7.30	2.15	2.50	2.00	Met specifications
15 + 000	7.45	7.30	2.45	2.40	2.00	Met specifications
18 + 000	7.45	7.30	2.40	2.45	2.00	Met specifications
21 + 000	7.37	7.30	2.63	2.50	2.00	Met specifications
24 + 000	7.36	7.30	2.64	2.60	2.00	Met specifications
27 + 000	7.42	7.30	2.50	2.58	2.00	Met specifications
30 + 000	7.42	7.30	2.63	2.25	2.00	Met specifications
33 + 000	7.37	7.30	2.38	2.45	2.00	Met specifications
36 + 000	7.64	7.30	2.35	2.56	2.00	Met specifications
39 + 000	7.35	7.30	2.50	2.55	2.00	Met specifications
45 + 000	7.40	7.30	2.45	2.45	2.00	Met specifications
48 + 000	7.45	7.30	2.45	2.50	2.00	Met specifications
51 + 000	7.50	7.30	2.50	2.70	2.00	Met specifications
54 + 000	7.55	7.30	2.50	2.55	2.00	Met specifications
57 + 000	7.45	7.30	2.55	2.40	2.00	Met specifications
60 + 000	7.45	7.30	2.60	2.55	2.00	Met specifications
63 + 000	7.40	7.30	2.50	2.60	2.00	Met specifications
66 + 000	7.45	7.30	2.75	2.50	2.00	Met specifications
69 + 000	7.57	7.30	2.55	2.48	2.00	Met specifications
72 + 000	7.44	7.30	2.55	2.51	2.00	Met specifications
75 + 000	7.50	7.30	2.44	2.56	2.00	Met specifications

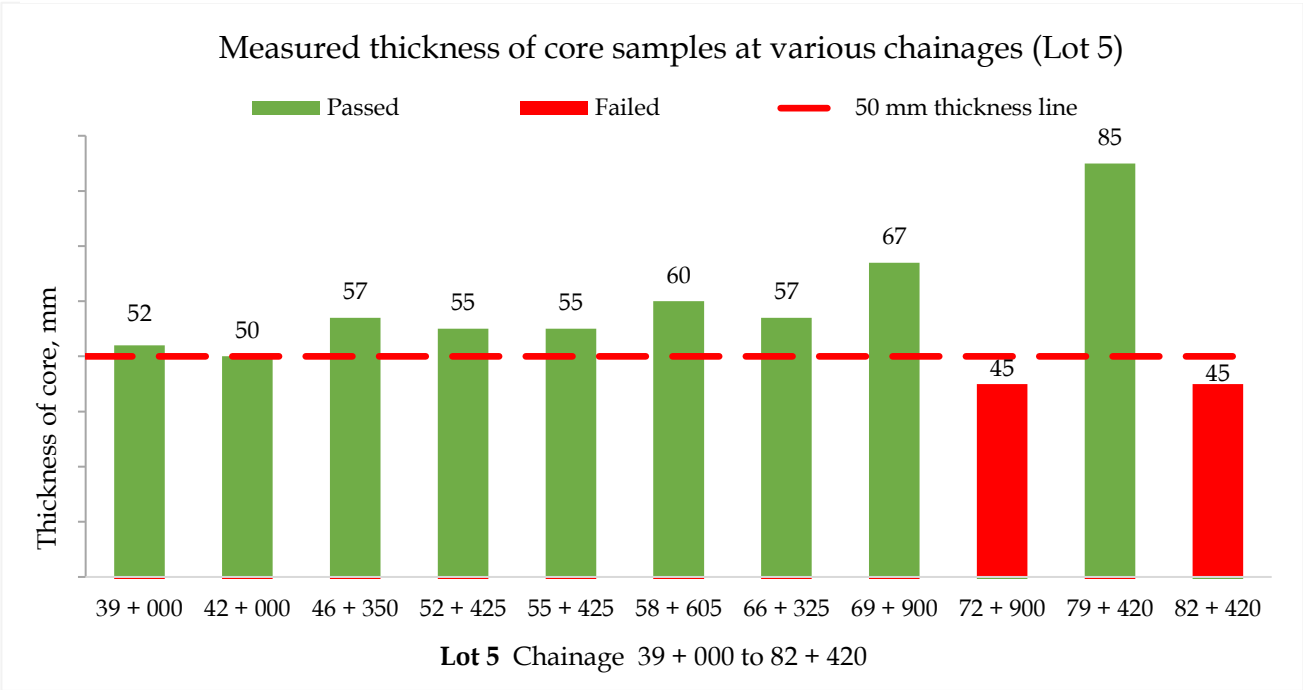
*Source: Audit Field Inspection Results, May 2019. NB: RHS is right hand side LHS is left hand side.*



154. From the data we collected on the road width measurements and Schmidt Hammer, the contractor met the specifications stated in contract for those parameters.

155. The team extracted 32 asphalt core samples and measured the thicknesses of the asphalt concrete layer with a tape measure. These measurements were taken in order to compare our readings with the contract specifications and to note any deviations. Figure 3 shows the measurements taken for the asphalt cores extracted from Lot 5. The bar graph in figure 3, shows that compared with the specified thickness of 50mm, 9 out of the 11 readings of the core samples met the specified thickness of 50mm while the remaining two did not meet the specified thickness. We also noted that eight of the 9 that met the specification were above the 50mm.

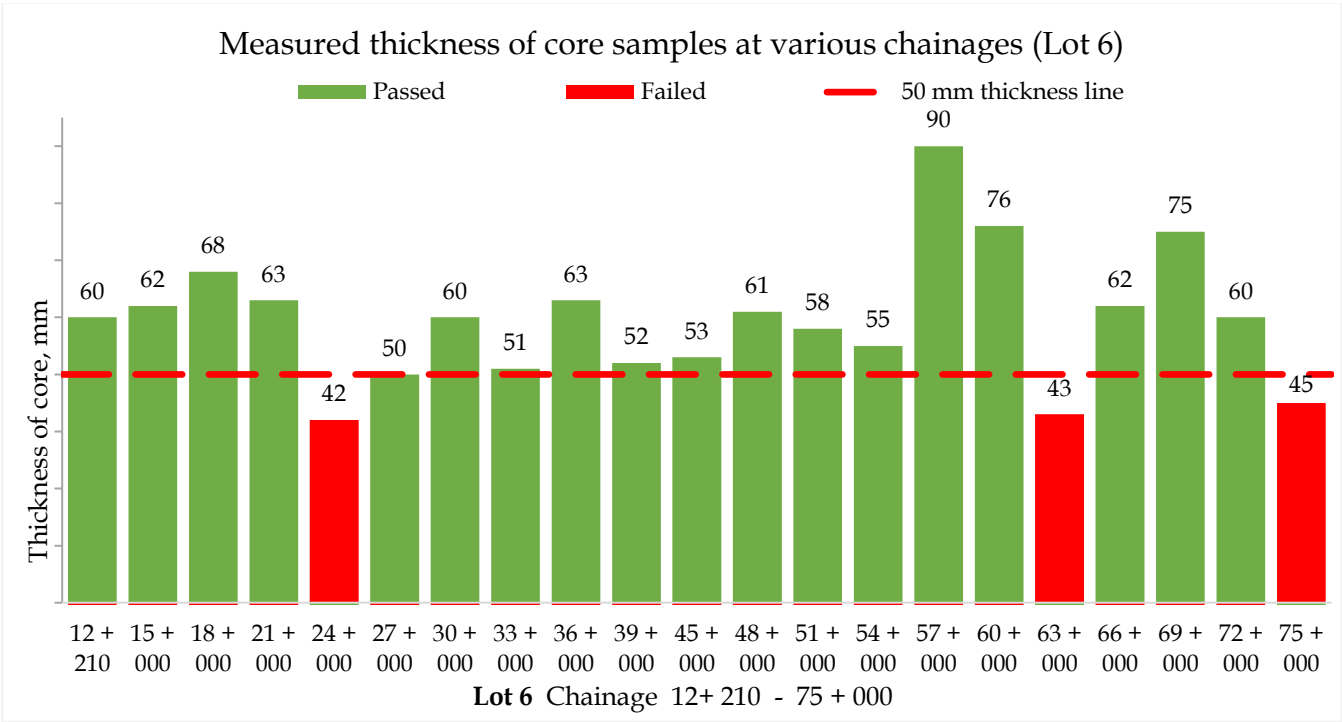
**Figure 2: Graph of Eastern Corridor Lot 5 asphalt core thickness**



*Source: Audit Field Inspection Result. NB: RHS right hand side LHS is left hand side*

156. Figure 4 shows the measurements taken for the asphalt cores extracted from Lot 6. The bar graph in figure 4, shows that compared with the specified thickness of 50mm, 18 out of the 21 readings of the core samples met the specified thickness of 50mm while the remaining three did not meet the specified thickness. We also noted that 17 of the 18 that met the specification were above 50mm.

**Figure 3: Graph of Eastern Corridor Lot 6 asphalt core thickness**



*Source: Audit Field Inspection Result. NB: RHS right hand side LHS is left hand side*

### **3.4.3 Implementation of the oil and gas enclave roads and the bridge over Amazure River**

#### **3.4.3.1 Scope management (Variations)**

157. The scope of the Oil and Gas Enclave Road Project was to construct 10.0km of asphalt road from Alabokazo to the Liquefied Petroleum Gas (LPG) loading gantry for the Ghana National Gas Company Limited (GNGCL) at Atuabo. The project consisted of the improvement of 3.8km existing road, construction of a new 6.2km alignment built on an embankment and a 60.0m span bridge over the Amazure River. The scope also included one box culvert and 20 No. 900mm pipe culverts. The width of the road was 7.3m carriageway, 2.0m wide asphaltic surfacing shoulder and 0.5m gravel/ stone pitching surface on the left-hand and right-hand sides.
158. We used the odometer of the car to determine the length of the road constructed from Alabokazo to Atuabo and found it to be 10.3km instead of 10.0km as specified in the contract. The bridge and culverts had also been constructed as specified in the original scope at the points as determined in the drawings.
159. There were changes to the scope which resulted in variations. We noted from the project files and interviews that during site clearance, the contractor encountered four swampy sections after the Amazure River. This increased the quantity of earthworks with excavations/cutting of unsuitable material, rock and sand to depths of up to 7.8m within the swampy sections and filling with suitable material (boulders) shown in Pictures 24 to 27.

## Swampy section encountered during site clearance

**Picture 24: Excavation of Swampy Section**



**Picture 6: Swampy Section encountered**



**Picture 7: Filling of swampy section**



**Picture 8: Filing and compaction of boulders**



**Source: Progress Pictures (July to October 2015)**

160. We noted that the following additions were made to the original scope of the project;

- 240m road extension to the loading gantry
- access roads to properties
- approximately 200m extension of road works at the intersections into the roundabout

161. The works constituting the variation order summed up to US\$ 6,708,172.24 which was more than 10% of the accepted contract amount. We noted that the variations which occurred were as a result of commencing the project without any feasibility studies and using preliminary designs obtained a week after the contractor's visit to site as mentioned in the finding on feasibility studies and project design. The details of V.O.1 are shown in Table 18. The contract had a contingency of US\$ 2.0 million dollars and hence the net variation was US\$ 4,708,172.24

**Table 19: Details of Variation Order No. 1**

No.	Item Description	Additional amount required (US\$)
1	Road works	5,303,370.49
2	Approach road to roundabout	235,937.00
3	Proposed road crossing	387,414.75
4	Link road to Ghana gas loading gantry at Baku	302,712.50
5	Pedestrian crossing road	88,452.50
6	Reinforced concrete culvert over existing gas pipeline	390,285.00
	Total	6,708,172.24

*Source: Audit team review of Variation order No. 1 dated 27 April 2016*

162. The PPA, Act 663, Section 87 (1) requires the procurement entity to obtain clearance from the Tender Review Board that reviewed the contract, where a variations order result in an aggregate increase in the contract sum by more than 10 percent. On 29 July 2016, GHA submitted a request to GNGCL (the Employer) for approval of V.O.1 in the sum of US\$ 4,708,172.24 (21.54% of contract sum). On 11 October 2016 the Ministry of Petroleum sought approval for V.O. No.1

from the CTRB, which was granted on 4 November 2016 in the sum of US\$ 4,708,172.24.

#### **3.4.3.2 Cost Management (Payment for works)**

163. Sub Clause 14.7 (a and b) of the General Conditions of contract stipulates that the Employer shall pay the contractor the first instalment of the advance payment within 42 days after issuing the letter of acceptance or within 21 days after receiving documents in accordance with sub-clause 4.2 (Performance Security) and subclause 14.2 (Advance payment). We noted that the Employer paid the Advance Mobilization of US\$ 7,327,756.00 to the contractor on 11 February 2015, this was 140 days after submission of the Acceptance letter; 119 days after submission of performance security; and 100 days after the submission of the advance mobilization security.

164. We noted that between December 2014 and March 2019, 15 interim payment certificates (comprising 12 for works and 3 interest claims) amounting to GH¢ 5,186,342.75 and US\$ 21,856,545.45 were raised and certified by the Resident Engineer. At the time of the audit, 8 IPCs amounting to GH¢ 3,568,828.35 and US\$ 18,145,224.06 had been honoured by the Ministry of Energy and Petroleum. The time of payment on all certificates exceeded the 56 days deadline as stipulated in Sub-Clause 14.7 (b) of the General Conditions of Contract as shown in Table 19. These delayed IPCs attracted interest on delayed payment which amounted to GH¢ 410,870.24 and US\$ 170,731.03, calculated based on delays between 21 and 436 days. The contractor made claims for the interest amounts through IPCs 6A, 9A and 11A in line with Sub-Clause 14.8 of the General Conditions of Contract.

165. We also noted that the process of IPC validation starts from site where the GHA representative on site vets the contractor's claims. The IPC then goes to

GHA head office for final scrutiny before being sent to GNGCL and Ministry of Petroleum for payment. For the IPCs that had been honoured, the process took between 77 and 492 days for payment to be affected.

**Table 20: Details of payment to the contractor as at June 2019**

Certificate No.	Contractor's Submission Date	Date certificate was raised by R.E.	Amount certified (GH¢ )	Amount (US \$)	Date certificate was honoured	Days beyond 56 days
2.	23-12-14	24-12-14	-	1,640,872.79	25-05-15	97
3.	23-04-15	06-05-15	387,496.38	2,691,475.21	09-07-15	21
4.	01-06-15	15-06-15	-	2,269,997.16	23-11-15	119
5.	02-08-15	17-08-15	-	834,023.96	06-12-16	436
6.	04-11-15	04-11-15	477,670.72	838,346.76	06-12-16	342
6A	15-12-15	15-12-15	3,165.04	51,472.08	Unpaid <sup>8</sup>	1237
7	23-12-15	23-12-15	44,512.50	1,324,243.39	06-12-16	293
8	22-02-16	22-02-16	1,215,705.00	261,967.26	06-12-16	232
9	06-05-16	31-05-16	1,333,468.74	810,514.78	Unpaid	1094
9A	26-05-16	02-06-16	106,809.97	94,554.67	Unpaid	1074
10	19-09-16	23-09-16	1,316,618.75	637,546.93	Unpaid	958
11	13-11-16	25-11-16	-	2,030,165.24	Unpaid	903
11A	30-11-16	14-12-16	300,895.65	24,704.28	Unpaid	886
12	16-12-16	20-12-16	-	1,018,904.94	Unpaid	870

*Source: Audit Team Review of IPCs*

166. We noted from our analysis of the trail of IPCs that, apart from IPC 2 which was returned to GHA due to inclusion of items which the Ministry refused to pay and hence caused the delay, all other IPCs which had challenges with payment was due to the extended period of time it took to process payment after

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<sup>8</sup> Unpaid as of 30 June 2019

the IPC left GHA to GNGCL and Ministry of Petroleum. From Table 19, our analysis shows that it took 21 to 436 days to pay for certificates sent to GNGCL and Ministry of Petroleum. We found through review of project documents and corroborated by the Project coordinator of GNGCL that GNPC was to pay for work done to be reimbursed by Ministry of Finance (MOF). However, MOF did not reimburse GNPC for earlier payments for which reason subsequent IPCs were not honoured by GNPC. At the time of the audit in June 2019, IPCs 6A,9,10,11,11A and 12 totalling GH¢ 2,954,148.18 and US\$ 4,573,308.25 had not been paid. The contractor is entitled to make interest claims on the unpaid IPCs under Sub-Clause 14.8 of the General Conditions of Contract and this would contribute to a higher cost for the project.

#### **3.4.3.3 Time management (Completing the works on time)**

167. Section 7 Sub-clause 8.2 of the General Conditions of Contract requires the Contractor to complete all works stated in the contract, including passing of tests as required for the purpose of Taking-Over, within the Time for Completion.

168. We noted that the project commenced on 15 December 2014 and was scheduled for completion on 15 August 2015 (8 months). On 15 July 2015 (one month to the expected completion date), M/S CHICO wrote to GHA claiming an extension of time from 12 August 2015 to 8 February 2016 (182 days). GHA granted 118 days extension of time to 8 December 2015 for the following reasons;

- Inability to work from CH 0+000 to CH 0+400 due to compensation issues
- Additional works to the scope (145m addition to the length of the road, 2 No. 100m approach roads to roundabout from 30m, and others)
- Unforeseen physical condition, and



- Non-Payment of Advance Mobilization.

169. On 20 November 2015 the contractor wrote to GHA to request for a second extension of time to 11 April 2016 (117 days) due to inability to work in CH 0+000 to CH 0+400 and additional works (huge quantities of cut and fill) in the swampy area. GHA recommended 144 days extension of time from 8 December 2015 to 8 April 2016 for consideration and approval by GNGCL. On 8 July 2016, GNGCL retrospectively approved the Extension of Time Nos. 1 and 2 to 30 April 2016.
170. The amount allocated for compensation of PAPs was US\$ 500,000.00 which was less than the actual compensation and so the Employer on 17 November 2015 requested the Contractor to advance the compensation cost of GH¢ 1,756,709.00 to 136 Project Affected Persons (PAP). Although the contractor obliged and commenced payment on 15 January 2016, relocation of the PAPs to make way for the clearing of the site delayed. Consequently, the contractor served notice to reduce the rate of works on 19 May 2016 due to lack of access to work in CH 0+000 to CH 0+400. GNGCL then gave possession of site on 27 May 2016 in response to the contractor's threat to reduce the rate of works. The problems with completion still persisted and subsequently a third Extension of Time was granted from 30 April 2016 to 28 February 2017 to enable the contractor complete the works.
171. Due to the delay in giving access to the contractor of CH 0+000 to CH 0+400, additional works and unknown site conditions, the project which was scheduled for completion on 8 August 2015 was completed and taken over on 28 May 2018 (33 months or 1,024 days after the scheduled completion date). Our assessment based on analysis of the information presented to the team show that poor planning from the onset of the project, coupled with lack of proper feasibility survey data to aid decision making contributed to the challenges encountered during implementation and resulting in the delay.

### 3.4.3.4 Delivering the Project to the quality expected

172. Section 8 of the General Conditions of Contract provides both standard and special specifications which the Contractor is to adhere to. Section 2 of the Specifications spells out the tests on materials and the required level of workmanship required for the project. The tests include:

- Grading,
- Compaction,
- Concrete tests, and
- Asphalt tests

173. The Specification for concrete works for drains and pipe culverts for the Oil and Gas Enclave Road project was C20/25<sup>9</sup>. The specifications for the Amazure bridge was C30/20 for the piers and C50/20 for the T-Beams. For the road, the carriageway width was 7.3m shoulder width was 2.0m and 0.5m gravel/ stone pitching in each direction. The specification of the pavement structure of the road was 660mm made up of 50mm wearing course, 60mm binder course, 350mm base and 200mm sub-base.

174. The audit team inspected the works carried out by the contractor and measured the length of the road, width of the carriageway and dimensions of culverts in the presence of representatives of the Contractor, GHA and GNGCL. We used the odometer of the car to determine the length of the road constructed and found it to be 10.30km from Alabokazo to Atuabo. We also took Schmidt hammer readings of concrete structures. These measurements

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<sup>9</sup> Concrete grade/ strength class C20/25 with a minimum cylinder strength of 20N/mm<sup>2</sup> and a minimum cube strength of 25N/mm<sup>2</sup>.

were taken in order to compare our readings with the contract specifications and to note any deviations. Our observations from the field inspection are shown in Tables 21 and 22.

**Table 21: Oil and Gas Enclave Road Project road measurements**

<b>Chainage</b>	<b>Width of Road, as measured by audit team in meters</b>	<b>Width of road as specified in contract in meters</b>	<b>Width of Shoulder as measured in meters (LHS)</b>	<b>Width of Shoulder as measured in meters (RHS)</b>	<b>Specified shoulder Width on both sides in meters</b>	<b>Remarks</b>
0 + 100	7.33	7.30	2.05	2.05	2.0	Road Width met specified width
0 + 200	7.25	7.30	5.70	5.61	2.0	Extra lane and bus stop
0 + 475	7.31	7.30	1.94	2.05	2.0	Road Width met specified width
0 + 485	7.29	7.30	2.01	2.00	2.0	Road Width met specified width
0 + 650	7.29	7.30	1.96	2.00	2.0	Road Width met specified width
5 + 080	7.31	7.30	2.06	2.03	2.0	Road Width met specified width
7 + 050	7.32	7.30	2.10	1.98	2.0	Road Width met specified width
8 + 200	7.31	7.30	1.94	1.95	2.0	Road Width met specified width
10 + 150	7.33	7.30	2.00	2.07	2.0	Road Width met specified width

*Source: Audit Field Inspection Results, 6 May 2019*

**Table 22: Oil and Gas Enclave Road Project Schmidt Hammer Readings**

Location of Structure/Chainage	Type of Structure	Schmidt Hammer Reading (N/mm <sup>2</sup> )	Specified Strength (N/mm <sup>2</sup> )	Remarks
0 + 475	2mx2m Box Culvert (HW inlet)	44	30	Met Specification
0 + 475	2mx2m Box Culvert W/W Approach inlet	42	30	Met Specification
1 + 617	Bridge Abutment Approach	52	30	Met Specification
1 + 750	1.2m double pipe culvert H/W	45	30	Met Specification
1 + 750	1.2m double pipe culvert approach W/W	35	30	Met Specification

*Source: Audit Field Inspection Results, 6 May 2019*

175. Our site measurement for the listed parameters compared with the contract specification show that they met specifications. Although these specifications were met, we noted that a section of the road, between CH 1+700 and CH 1+ 800, after the Amazure Bridge had the asphalt layer cracked and showing a dip/depression on the surface of the road measuring 46.0m. The settlement covered the entire width of the road and had caused cracks in the stone pitching on the left hand and right-hand side of the road as shown in Pictures 28 to 31.

**Picture 9: Settlement in Road**



**Picture 10: Settlement after Amazure Bridge towards Atuabo**



**Picture 11: Crack in Embankment due to settlement**



**Picture 12: Crack in Asphalt due to settlement**



*Source: Audit Team Inspection on 6 May 2019*

176. The team noted that the settled portion of the road is located at the swampy section which was filled with boulders, selected suitable material and compacted for the formation of the road layers. The contractor's representative present during the site inspection attributed the settlement to be due to subterranean movement of the layers forming the road underneath the asphalt layer. The representative also stated that they were in the process of assessing to provide a solution to the settlement.

177. We reviewed results of tests conducted on the concrete, earthworks and asphalt to determine whether GHA quality control measures had validated the work before it was done and what could have caused the depression and crack on the road. Our review showed that GHA had checked and indicated as being satisfactory and having met specifications. A sample of these test results is attached as Appendix 4.

## Conclusions

178. There were scope changes during the implementation of the East Legon to Spintex Road Tunnel project. This was because of a lack of traffic studies, as a feasibility study was not carried out on the project. Also, the project was not completed on time (10 calendar months) as the contractor asked for an extension of six months to enable him execute the changes GHA introduced on the Project. Where delays were due to GHA internal arrangement, the project cost could increase by GH¢ 1,630,481.65 if the contractor apply Sub-Clause 14.7 on interest on delay payment on the outstanding three IPCs .On quality assurance and quality control, GHA put in place satisfactory mechanisms to ensure adherence to specification in the contract.

179. The variations approved on the Eastern Corridor road project resulted in a reduction in the length of the project by 41.3km. This was to cater for the cost of the three variations while keeping the contract sum fixed. In addition, the project, which started on 19 May 2014 and was scheduled to be completed on 4 November 2016 was 76% complete at the time of the audit. The contractor suspended works due to delays in payment for 12 months and was granted 21 months extension by the Ministry to complete the works with a cost compensation of US \$ 23,762,165.35.

180. The Oil and Gas Enclave road project was not completed on schedule due to variations brought about by swampy sections encountered due to the fact that the project commenced without detailed feasibility and engineering studies as the contractor was given four days to visit the site and prepare his estimate. The cost overruns which occurred were due to the variations, compensation of project affected persons, relocation of utilities and claims for delay in payment. The delay in completion was partly due to the swampy sections encountered, delay in relocation of project affected persons and utilities during implementation. The defect which was observed on the road raises doubt about the quality of the work implemented at the failed section of the road.

## **Recommendations**

181. To ensure proper implementation of current and future road projects, we recommend that GHA should;

- vii. have complete drawings and designs that will inform realistic cost estimates and clearly define the scope of works of all projects,
- viii. fulfil all relevant conditions of relocation and compensation precedent to project commencement,
- ix. Cease implementation of any project which does not have secured and available funding capable of meeting all projected costs.
- x. institute and implement a policy on processing time for each stage of the validation process of IPCs to guide against undue delays beyond 56 days and sanction officers who delay each IPC with cost of claims due to the delayed IPC,
- xi. Reduce the clearing process of Interim Payment Certificate where possible.

- xii. seek approval for all variation in accordance with Section 87 (1) of the PPA Act 663 before implementation
- xiii. Reject any works done by contractors which do not meet contract quality specification and ensure such works are redone to quality.
- xiv. Institutionalise prescribed maintenance regime to prolong project life after completion.



### **3.5 COMPLETION AND DOCUMENTATION**

#### **3.5.1 Completion**

182. Under Clause 48 of the General Conditions of the Contract, the Engineer (GHA) is to issue a Taking - Over Certificate in respect of the whole or any substantial part of the works that has been completed and has passed the required tests, when the Engineer deems the works or any part of it to be substantially completed and ready for use. In line with industry best practice, we expect GHA to carry out take - over inspection, and ensure the contractor provides as-built drawings and maintenance manuals.

183. The East Legon to Spintex Road Tunnel project started on the 1 August 2017 and was expected to be completed on the 31 May 2018. Our review of the Taking over Certificate issued by GHA through the Resident Engineer showed that the project was substantially completed on 28 August 2018.

184. We noted that prior to the substantial handing over; a technical team from GHA inspected the project site and asked the contractor to carry out the following additional works;

- Provision of walkway through the existing tunnel.
- Provision and installation of adequate streetlights and tunnel lights along the walkway
- Artistic painting of the inside of the existing tunnel
- Installation of Height Restrictive Post (Gantry Post) on both approaches to the new tunnel
- Construction of the exclusive right-turn on the Spintex Road.

185. The project is currently in its Defect Liability Period (DLP), to end on 28 August 2019, a year after the substantial completion. We noted through correspondence that a technical team from GHA and the contractor jointly inspected the project on 16 July 2019 prior to the end of the DLP and prepared the following Snag list with 10 items for rectification by the contractor to pave way for Final Handing Over:
186. For the Oil and Gas Enclave Road Project we noted that the Contractor wrote to GHA for inspection of the works at completion on. The Resident Engineer inspected the road works and presented a pre-taking over snag list to the contractor on 25 October 2017 for implementation. The snag-list contained 21 defects observed and comments by the RE which the Contractor was to rectify prior to the taking over inspection. The Resident Engineer Informed the Chief Executive of GHA of the substantial completion inspection of the project to take place on the 21 March 2018.
187. GHA formed an inspection team comprising officers from GHA head office (nine), Project Supervision Team, Ghana national Gas representatives (five), the Contractors staff (3) and sub-contractor (one) to inspect the works on the 21 March 2018. The inspection team made observations of defects the bridge, absence of streetlights and depression on the road at CH 1+775 to CH 1+800 and asked the contractor to repair the defects within DLP. The inspection team agreed to take over the works on 21 March 2018. Hence in accordance with Sub-clause 10.1 of the conditions of contract, GHA issued the taking over certificate for the works in a letter dated 21 March 2018. The certificate was signed by the Acting Chief Executive.
188. The project was in defects liability period at the time of the audit inspection in May 2019 as the contractor had not rectified the depression in the road that

occurred during the defects liability period and also not installed the street lights on the road.

### **3.5.1 Documentation**

189. The purpose of documentation is to provide a written record of all aspects of the works and is important that an accurate record of the project is maintained from the onset of the project until its completion.
190. An efficient document management standards and procedures for use on the project ensures that projects are constructed in accordance with the contract documents and also serves to provide evidence of historical account of how and why changes were made and to help defend against unwarranted claims in an event of legal action.
191. We assessed GHA documentation of the three project and found that filing and maintenance of documents was generally poor. There was no segregation of documents as different categories of documents were mixed in the project files.
192. There were no pre-qualification documents, copies of submitted tenders and evaluation reports in the project files for us to review. Also, there were missing variation orders, IPCs, some minutes of site meetings and progress reports even in the close files. This problem made project tracking and administration difficult as information needed for management to take decisions were not kept in a systematic way.

### **3.6 OVERALL CONCLUSION.**

193. Following our review of information on the selected projects, we are of the opinion that projects planning need to be improved to ensure value for money. The Survey and Design Unit of the GHA is not supported well to compile data on the roads in the country to aid planning and review. The summary in Table 23 shows the extent of cost and time wasted for which implementation of our recommendations seek to address.

Table 23: Summary of project issues

East Legon- Spintex Road Tunnel project		
Contract sum	GH¢14,815,261.46	
Final cost	GH¢28,125,502.86	
Projected completion time	10 months	
Final completion time	12 months	
Core Samples taken	7	
Number passed	5	
Variation	GH¢10,504,982.66	
Others	GH¢2,805,258.74	
Work unrelated to contract	Not applicable	
Total interest on delayed payment (Part of final contract Sum)	(GH¢1,630,481.65) Not claimed yet at the time of the audit	
Payment for extension of time	Not applicable	
Eastern Corridor Lot 5 and 6 road project		
Contract sum	\$290,642,200.00	
Final cost	\$290,642,200.00	
Projected completion time	30 months	
Final completion time	64 months (Project still on-going as at the time of audit and 76%complete)	
Core Samples taken	32	
Number passed	27	
Work unrelated to contract	Not applicable	
Total interest on delayed payment (Part of final contract Sum)	Converted to reduction in scope of works	
Payment for extension of time	US \$ 23,762,165.35 (Converted to reduction in scope of works)	
Oil and Gas Enclave road project		
Contract sum	US\$21,859,390.00 (GH¢ 59,490,195.70)	
Final cost	US\$ 14,528,789.45	GH¢5,186,342.75
Projected completion time	10 months	
Final completion time	33 months	
Core Samples taken	None	
Number passed	Not applicable	
Work unrelated to contract	Not applicable	
Variations	US\$4,708,172.24	
Total interest on delayed payment (Part of final contract Sum)	GH¢ 410,870.66	US\$ 170,731.03
Payment for extension of time	Not applicable	

**Source: Summary from audit findings**

194. GHA's strategic goal of cost effective road development in the country in our opinion cannot be realised if delayed payment on certificates are not managed to reduce interest, which constitutes a significant portion of the final contract sums.

Also constant variations either by reducing scope to match budget or introducing other projects and attaching them to ongoing ones is an upfront to Value for Money assessment, makes it difficult to determine cost and to compare with similar works.

195. Delays in completing the roads have both direct and indirect financial and economic consequences to the country. The direct financial cost due to delays in completing the projects are in the payment of interest on delayed payment and fluctuation due to changes in prices of materials. The indirect cost although cannot readily be assessed in financial figures, we are certain they are significant for the following reasons.

1. Vehicles use longer hours plying the road to transport foodstuff to markets centers, which end up getting rotten, and /or the prices are hiked and transferred to consumers.
2. Constant breakdown of vehicles due to the poor nature of the uncompleted roads affect the income of the transport owner and subsequently the ordinary consumer.
3. The dusty nature of the uncompleted roads impact negatively on the health of the residence along the road corridor and affecting valuable economic productive hours.
4. Deprives residents living along the stretch of the road access to social services like hospitals in a speedy manner.

196. In our view, GHA has to adhere to international good practice by ensuring that scope is well defined and adhered too, funding is sourced or known and implementation is monitored to avoid unnecessary escalation of cost.

## **CHAPTER FOUR**

### **APPENDIXES, ANALYSIS SHEETS & SOME SUPPORTING DOCUMENT**

#### **Appendix 1. List of Documents reviewed**

- Contract Documents
- Project Drawings
- Correspondence
- Monthly Progress reports
- Minutes of site meetings
- Interim payment certificates
- 2018 Annual Progress Report
- 2017 to 2037 Strategic Plan
- Variation Orders
- Ministry of Transportation Standard Specifications for road and bridge works (2007)

## **Appendix 2. List of interviewees**

- Chief Executive
- Deputy Chief Executive
  - Development
  - Administration
- Directors
  - Planning
  - Survey and Design
  - Quantity Surveying
  - Contracts
  - Materials
  - Estate
- Resident Engineers
  - East Legon – Spintex Road Tunnel
  - Oil and Gas Enclave Roads
  - Eastern Corridor Road Projects Lot 5 and 6

197.



- Other staff of GHA
- Ministry of Roads and Highways
  - Director (Finance)
  - Deputy Director (Finance)
- Road Fund Secretariat
  - Coordinator
- Ministry of Finance
- Consultants
  - Associated Consultants
    - Project Director
    - Resident Engineer
- Contractors' Representatives
  - Messrs Sonitra
    - Project Managers for
      - East Legon – Spintex Road Tunnel
  - China Henan International Cooperation Group Co. Ltd.

- Project Manager for Oil and Gas Enclave Roads
- Messrs Construtora Andrade Gutierrez S.A. and Construtora Norberto Odebrecht S.A.
- Project Manager for Eastern Corridor Road Projects Lot 5 and 6

### **Appendix 3. Field inspection and methodology**

#### **CARRIAGEWAY**

- To ascertain existence of the road project and the status of completion
  - Traverse the length of the road, ascertain start and finish point and note the distance with the vehicle trip counter,
  - note any defects on the surface of the road from start to finish and record the locations and nature of defects.
  - Observe the road safety features and measures instituted and comment on their suitability or otherwise.
  - Observe road signs and their location and comment on the quality and adequacy.
  - Observe any potential risk areas along the road that might be susceptible to accidents.
- Take measurements of the length, width and shoulders of the road with the pedometer and compare with specifications and payments made. Measurements will be taken at intervals of 250m, 500m, 1km, 2.5km and 5km depending on the length of the road.
- Inspect and count the number and types of culverts constructed and compare with what was to be provided and paid for
  - Determine culvert locations from project drawings and observe the condition of the culvert with regards to whether the

workmanship was without defects, the culvert is performing its function and is not silted

- Take measurements of dimensions (length, width, depth of the culvert and compare with drawings (as-built)
- Take readings of strength of culverts and concrete drains with the Schmidt hammer to compare with the strength required
- Changes in the road design implemented during construction.

## CONCRETE TESTS

- The Schmidt Hammer was used to test the strength of concrete structures. Nine rebound values were taken at specific intervals of at least 5cm apart. Three readings were taken for three rows of tests. The rebound values were recorded on a data sheet.
- The highest and lowest rebound readings were omitted and the average taken of the remaining seven readings. The average value obtained was determined from the rebound hammer strength computation graph. The average value was read on the horizontal axis and the corresponding reading on the vertical axis corresponded to the measured strength of the concrete component. The measured strength obtained was compared with the strength specification to determine whether it met the specification or not.
- The Schmidt hammer tests were done on the internal walls of drains. For culverts the headwall, wingwall and barrel.

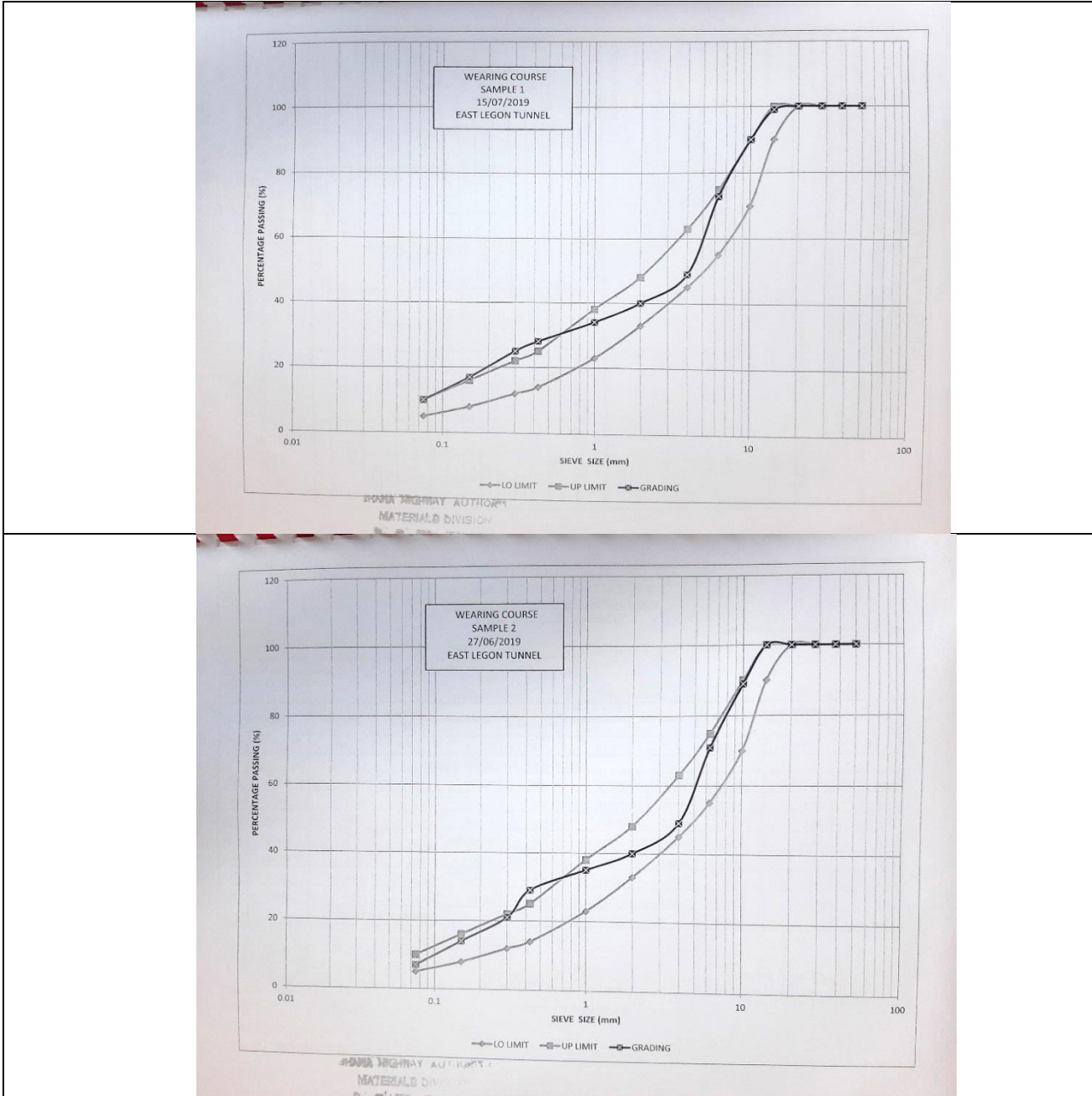
## ASPHALT

- For the asphalt works, the audit team cored the road at intervals to collect asphalt core samples. The core samples were taken at the centres, LHS and RHS edges of the roads at intervals to obtain a minimum representative sample in accordance with ASTM D979 and ASTM D5361.
- The thicknesses of the asphalt cores were measured with a Vernier calliper and recorded on the data collection sheet and compared with the specified pavement thickness to observe any difference from the designed thickness.
- The core samples were carefully stored in a containment box and taken to a materials laboratory (GHA) to conduct tests to ascertain whether it met specifications.
- The laboratory test results will be compared with the results of tests carried out during construction.
- The team cored the edges of the road to obtain samples of the pavement thicknesses for the base and sub-base. The thickness of the cored base course and sub-base sample were measured with a ruler and recorded on the data recording sheet. The measurements were compared with the specified layer thickness for the binder and wearing course.

Appendix 4. Laboratory test results of asphalt core samples

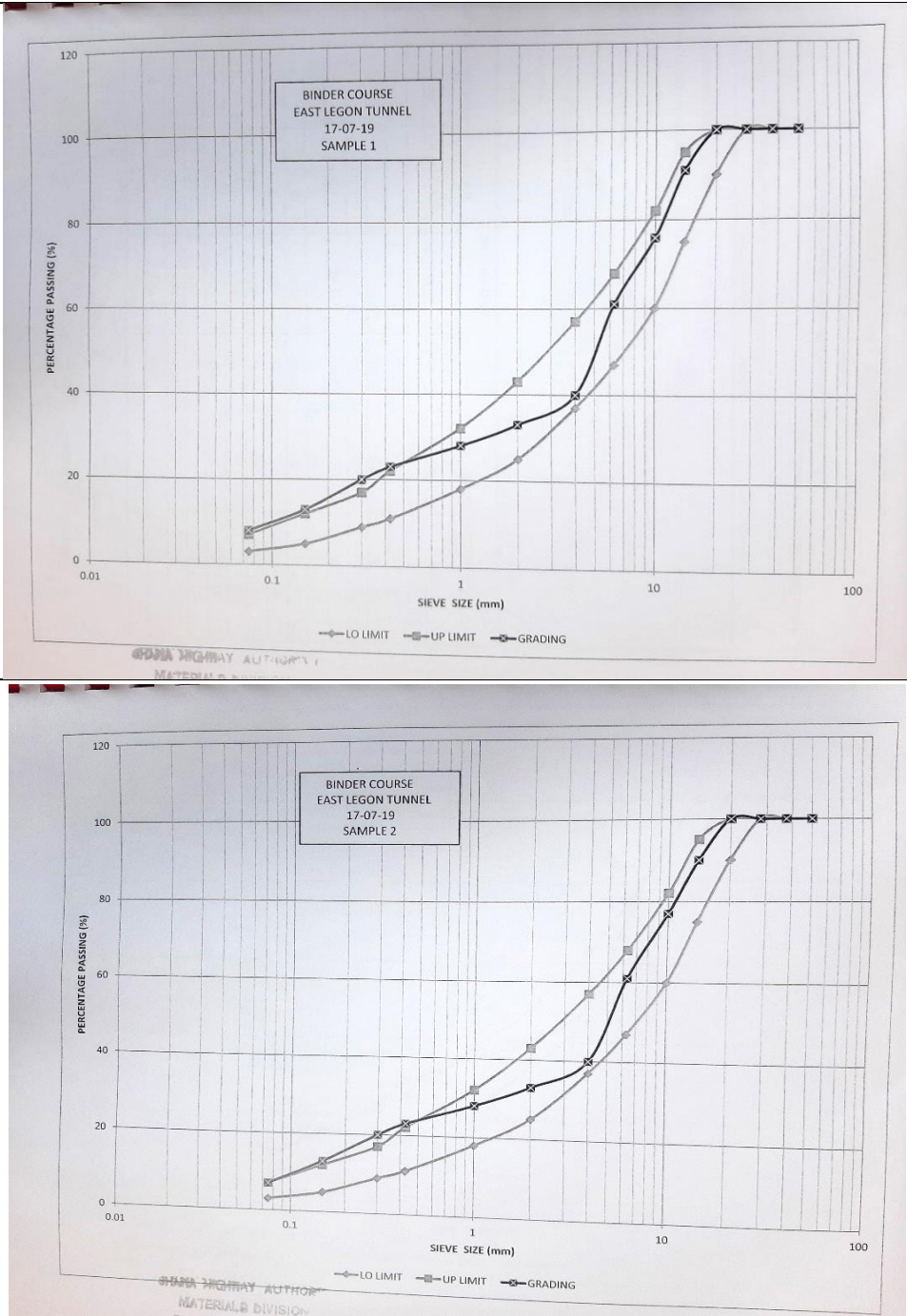
Grading curves for the East Legon to Spintex Tunnel

Table 24: Grading Curves for the East Legon to Spintex Tunnel Road (Wearing Course)



Source: Laboratory test results on extracted asphalt core samples dated 27 July 2009.

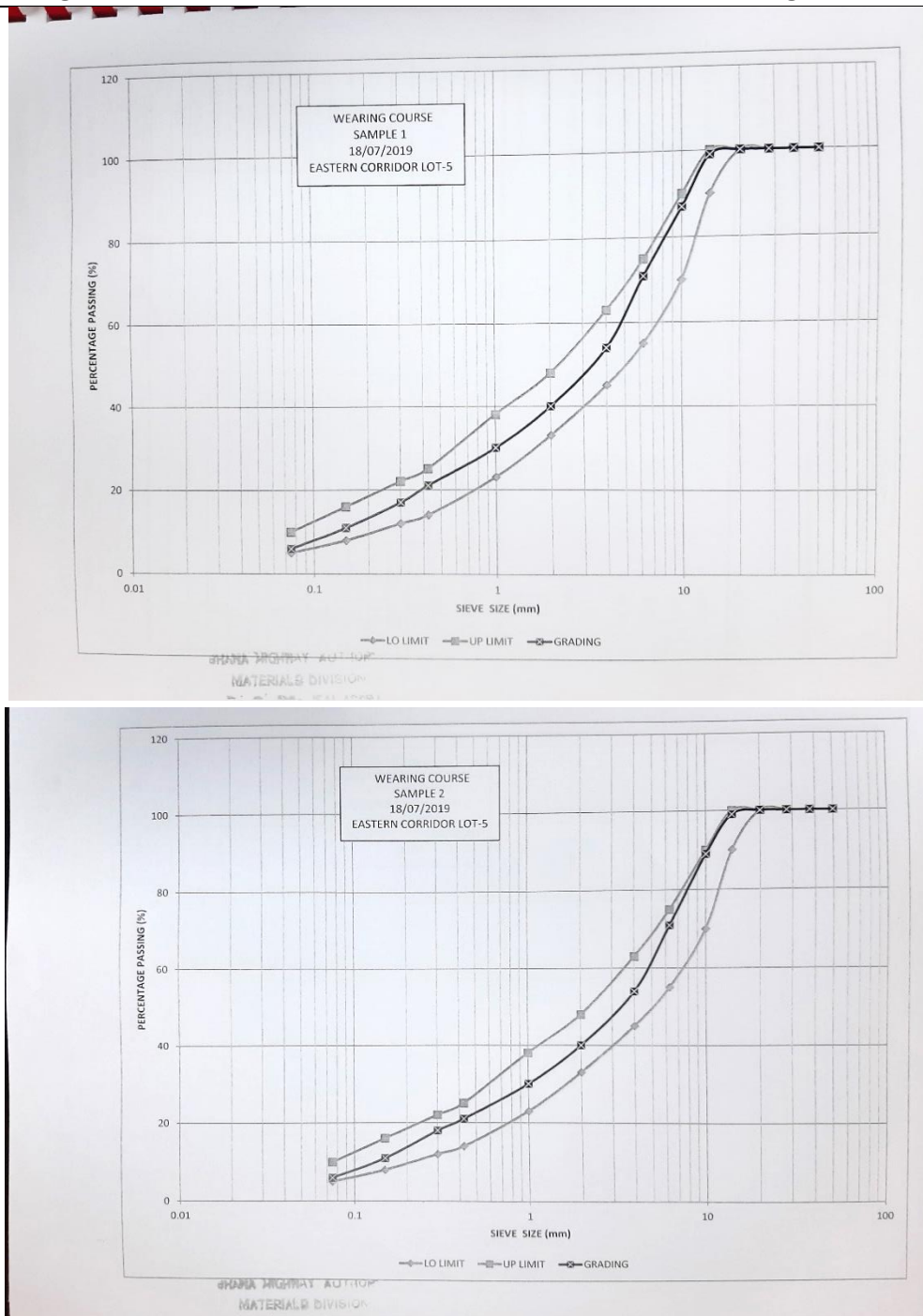
**Table 25: Grading Curves for the East Legon - Spintex Tunnel Road (Binder Course)**



Source: Laboratory test results on extracted asphalt core samples dated 27 July 2009.

## Grading curves for the Eastern Corridor Lot 5

**Table 26 Grading Curves for the Eastern Corridor Road Lot 5 (Wearing Course)**

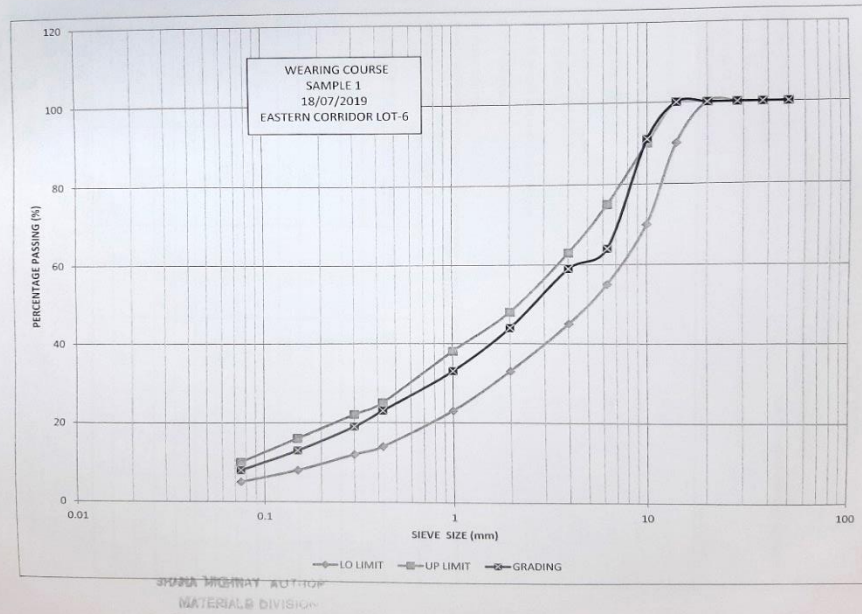


Source: Laboratory test results on extracted asphalt core samples dated 27 July 2009.



## Grading curves for the Eastern Corridor Lot 6

**Table 27: Grading Curve for Eastern Corridor Lot 6 (Wearing Course)**



Source: Laboratory test results on extracted asphalt core samples dated 27 July 2009

## **Appendix 5 Key players and their roles**

### **Ministry of Road and Highways (MRH)**

The Ministry of Roads and Highways (MRH) is responsible for formulating policies for the road transport sector, establishing the regulatory framework for road transport operations, investments and the development of an integrated road transport system.

The Ministry of Roads and Highways (MRH) is the Employer or the Project Owner and is represented by the Ghana Highway Authority acting for and on behalf of the Government of Ghana. The responsibility of the ministry as employer is to pay for projects being undertaken. MRH receives monthly progress report from GHA on road projects and reports to Cabinet. The Ministry also approves IPCs before they are submitted to Ministry of Finance for payment.

### **Ministry of Finance and Economic Planning (MOFEP)**

The Ministry of Finance and Economic Planning (MOFEP) provides the budget for road projects. MOFEP also disburses funds to settle compensation of property owners affected by the road construction and Interim Payment Certificates (IPCs) submitted by GHA on behalf of contractors.

### **Ghana Highway Authority**

The Ghana Highway Authority is under the Ministry of Roads and Highways and is responsible for planning, developing and administering road projects.

#### *The Chief Executive (CEO)*

The CEO is the head of GHA and appoints the Resident Engineer. The CEO approves changes suggested by the Resident Engineer. The CEO approves subcontracting of any parts of the works, variation orders, and issues taking over certificates. The CEO also reports on the status of road projects to the Ministry of Roads and Highways.

#### *The Development Department of GHA*

The Deputy Chief Executive heads this department comprising Planning, Contracts, Materials, Quantity Surveying, Bridges and Survey and Design Divisions. The Planning Division conducts feasibility studies, identifies right of way and buildings

for demolition to make way for the road as well as assessing properties for payment of compensation.

The Contracts Division prepares tender documents. The division also handles tendering and tender evaluation, construction planning (including relocation of utilities and compensation of affected properties) and reviewing IPCs.

The Materials Division is responsible for engineering studies and material investigations. The division also prospects for materials for construction.

The Quantity Surveying Division is involved in the preparation of preliminary cost estimates for projects. They also assist in the preparation of contract documents and the verification of quantities on IPCs.

The Bridges Division is responsible for identifying locations and designing bridges to be constructed.

The Survey and Design Division is responsible for gathering site information through various surveys, designing the road to be constructed and preparing engineering drawings for construction.

#### *The Resident Engineer*

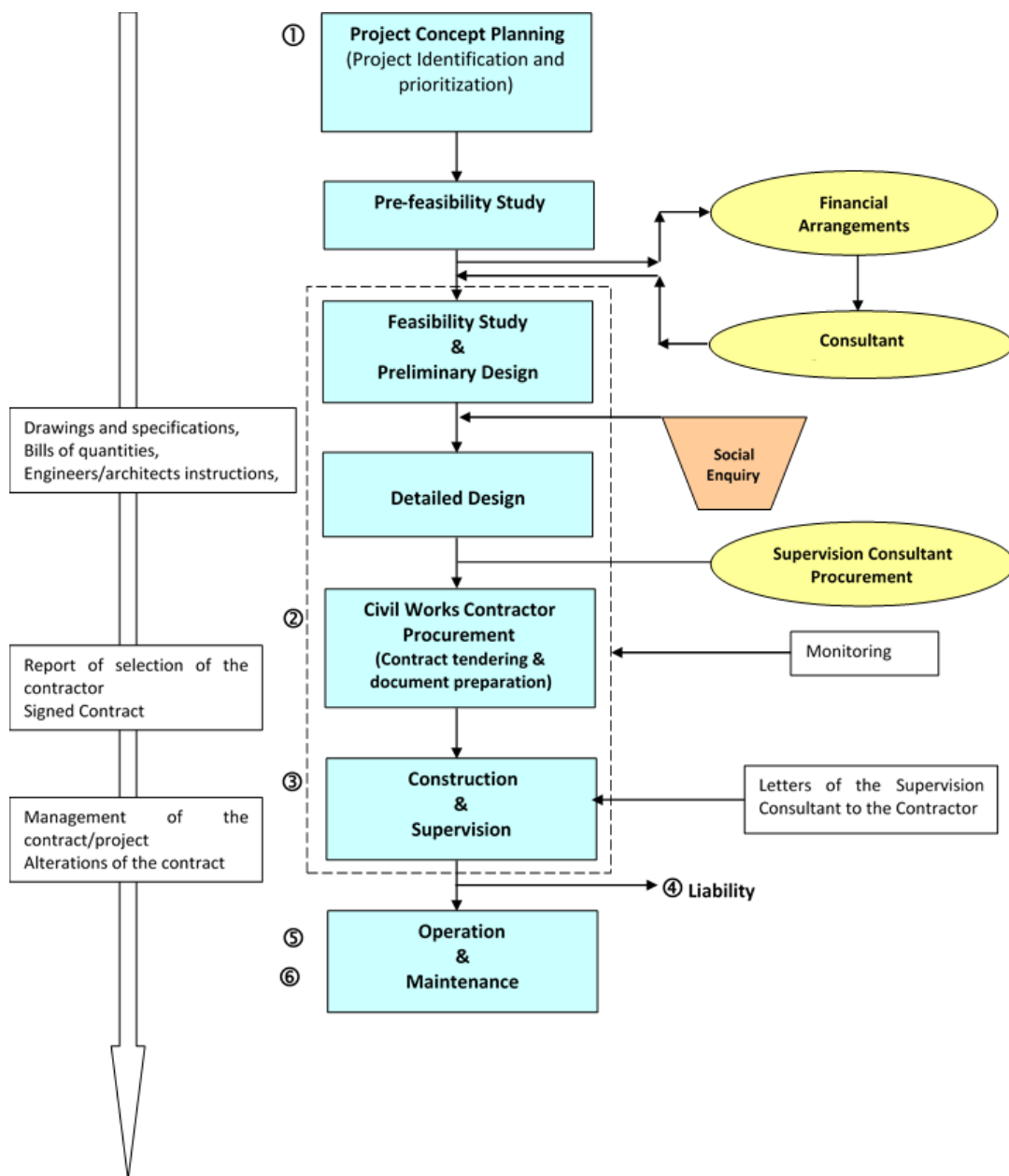
The Resident Engineer receives contractor's queries, issues instructions to the contractor, ensures the contractor follows good practices and approves work done by the contractor. The Resident Engineer also monitors progress of works and gives the CEO regular reports on the project through a Monthly Progress Report. He chairs monthly site meetings to discuss progress of work.

#### **The Contractor**

The Contractor is to execute the contract according to the drawings and specifications. They maintain the project site, receive instructions from the Resident Engineer and carries them out. They use sub-contractors and suppliers of goods and services to carry out some aspects of the contract and apply periodically for payment of work done. They conduct tests on materials and components, and forward test results to the Resident Engineer for approval.

## Appendix 6. Details of system description

### Figure 4: System Description



*Source: GAS Performance Audit Infrastructure Guide*

## Appendix 7. Table of road widths, core thickness as measured at road site and tests on concrete structures

### East Legon to Spintex Road Tunnel

**Table 28: Measured thicknesses of core samples on the East Legon-Spintex Tunnel**

Sample	Chainage (km)	Thickness of Core, mm
1	0 + 100 R	100
2	0 + 300 L	100
3	0 + 300 R	90
4	0 + 700 R	120
5	0 + 700 L	108
6	1 + 100 L	80
7	1 + 300 L	100

Source: Audit team field inspection results

**Table 29: Summary Statistics on core samples from the East Legon-Spintex Tunnel**

Specified combined thicknesses of wearing and binder courses	100 mm
Criteria	Count
>=100	5
<100	2
<b>Total number of samples</b>	<b>7</b>
Average thickness of core samples	99.7 mm
Maximum thickness of core samples	120 mm
Minimum thickness of core samples	80 mm

Source: Audit team field inspection results

**Table 30: Non-Destructive Schmidt Hammer Test Results on some concrete structures on the East Legon - Spintex Tunnel**

GHANA AUDIT SERVICE TECHNICAL AUDIT FIELD CHECKLIST														
NON-DESTRUCTIVE SCHMIDT HAMMER TEST RESULT SHEET														
▲	TESTED BY:										DATE:		09-04-19	
TITLE:		TECHNICAL AUDIT OF SELECTED ROADS IN GHANA												
▼	NAME OF PROJECT: East Legon - Spintex Tunnel													
LOCATION OF STRUCTURE	SCHMIDT HAMMER TEST READINGS (NB: impact points should be at least 20 mm apart)									ADJUSTED AVERAGE READING	TEST ANGLE (0°/90°/270°)	PROBABLE STRENGTH (N/mm²)	SPECIFIED STRENGTH (N/mm²)	REMARKS
	1	2	3	4	5	6	7	8	9					
LHS 45m Phase 2	46	40	42	42	31	51	44	43	50	44.000	0°	48	40	PASSED
LHS 30 m Phase 3	49	35	49	45	45	45	40	49	44	45.000	0°	50	40	PASSED
LHS 15 m Phase 1	51	40	43	51	40	51	53	49	52	48.000	0°	54	40	PASSED
RHS 45 m Phase 1	40	48	47	41	42	41	44	40	39	42.000	0°	45	40	PASSED
RHS 30 m Phase 3	41	39	47	41	44	28	41	31	43	40.000	0°	42	40	PASSED
RHS 15 m Phase 2	39	42	44	40	41	48	52	50	43	44.000	0°	48	40	PASSED
U-DRAIN														
0 + 120	30	32	30	32	32	35	33	29	29	31.000	0°	29	25	PASSED

0 + 300 (heading towards American house - Eastbound)	25	28	34	35	29	25	31	34	31	30.000	0°	28	25	PASSED
Core 2 & 3 U- Drain (300 south bound)	37	40	42	44	34	38	38	40	39	39.000	0°	40	25	PASSED

Source: Audit team field inspection results

**Table 31: Stratified Random Sampling on the East Legon-Spintex Tunnel Road**

Chainage	LHS				RHS			
1 + 300		17		18	19			20
1 + 100		16		15	14			13
0 + 700		9		10	11			12
0 + 300		8		7	6			5
0 + 100		1		2	3			4

Source: Audit team worksheet

## Eastern Corridor Lot 5 & 6

**Table 32: Measured thicknesses of core samples on the Eastern Corridor Road Lot 5**

Lot 5					
Sample	Chainage (km)	Thickness of Core, mm	Width of shoulder LHS, m	Width of shoulder RHS, m	Width of Road, m
1	39 + 000	52	2.55	2.50	7.45
2	42 + 000	50	2.46	2.77	7.47
3	46 + 350	57	2.35	2.82	7.53
4	52 + 425	55	2.83	2.70	7.45
5	55 + 425	55	2.60	2.50	7.50
6	58 + 605	60	2.50	2.80	7.50
7	66 + 325	57	2.35	2.40	7.50
8	69 + 900	67	2.47	2.54	7.39
9	72 + 900	45	2.50	2.46	7.44
10	79 + 420	85	2.44	2.35	7.51
11	82 + 420	45	2.45	2.40	7.45

*Source: Audit team field inspection results*



Table 33: Summary Statistics on core samples from the Eastern Corridor Road Lot 5

Specified thicknesses of wearing course	50 mm
<b>Criteria</b>	<b>Count</b>
>=50	9
<50	2
<b>Total number of samples</b>	<b>11</b>
Average thickness of core samples	57 mm
Maximum thickness of core samples	85 mm
Minimum thickness of core samples	45 mm

Source: Audit team field inspection results

Table 34: Measured thicknesses of core samples on the Eastern Corridor Road Lot 6

Lot 6					
Sample	Chainage (km)	Thickness of Core, mm	Width of shoulder LHS, m	Width of shoulder RHS, m	Width of Road, m
21	12 + 210	60	2.15	2.50	7.65

Lot 6					
Sample	Chainage (km)	Thickness of Core, mm	Width of shoulder LHS, m	Width of shoulder RHS, m	Width of Road, m
20	15 + 000	62	2.45	2.40	7.45
19	18 + 000	68	2.40	2.45	7.45
18	21 + 000	63	2.63	2.50	7.37
17	24 + 000	42	2.64	2.60	7.36
16	27 + 000	50	2.50	2.58	7.42
15	30 + 000	60	2.63	2.25	7.42
14	33 + 000	51	2.38	2.45	7.37
13	36 + 000	63	2.35	2.56	7.64
12	39 + 000	52	2.50	2.55	7.35
11	45 + 000	53	2.45	2.45	7.40
10	48 + 000	61	2.45	2.50	7.45
9	51 + 000	58	2.50	2.70	7.50
8	54 + 000	55	2.50	2.55	7.55
7	57 + 000	90	2.55	2.40	7.45
6	60 + 000	76	2.60	2.55	7.45
5	63 + 000	43	2.50	2.60	7.40

Lot 6					
Sample	Chainage (km)	Thickness of Core, mm	Width of shoulder LHS, m	Width of shoulder RHS, m	Width of Road, m
4	66 + 000	62	2.75	2.50	7.45
3	69 + 000	75	2.55	2.48	7.57
2	72 + 000	60	2.55	2.51	7.44
1	75 + 000	45	2.44	2.56	7.50

*Source: Audit team field inspection results*

**Table 35: Summary Statistics on core samples from the Eastern Corridor Road Lot 6**

Specified thickness	50 mm
<b>Criteria</b>	<b>Count</b>
>=50	18
<50	3
<b>Total number of samples</b>	<b>21</b>
Average thickness of core samples	59 mm
Maximum thickness of core samples	90 mm
Minimum thickness of core samples	42 mm

*Source: Audit team field inspection results*

**Table 36: Non-destructive Schmidt hammer test result sheet for some concrete structures for the Eastern Corridor Lot 5 & 6**

GHANA AUDIT SERVICE TECHNICAL AUDIT FIELD CHECKLIST														
NON-DESTRUCTIVE SCHMIDT HAMMER TEST RESULT SHEET														
▲	TESTED BY:	Stephen Narkotey										DATE:	29/04/2019 - 30/04/2019	
TITLE:		TECHNICAL AUDIT OF SELECTED ROADS IN GHANA												
▼	NAME OF PROJECT:		EASTERN CORRIDOR LOT 5 & 6									ROAD	Eastern Corridor Lot 5 & 6	
LOCATION OF STRUCTURE	SCHMIDT HAMMER TEST READINGS (NB: impact points should be at least 20 mm apart)									ADJUSTED AVERAGE READING	TEST ANGLE (0°/90°/270°)	PROBABLE STRENGTH (N/mm²)	SPECIFIED STRENGTH (N/mm²)	REMARKS
Lot 6	1	2	3	4	5	6	7	8	9					
Box Culvert														Remarks
65 + 986	50	44	46	52	38	51	51	42	49	48.000	0°	54	25	PASSED
Pipe Culvert Head wall														
12 + 210	52	54	54	54	54	52	51	46	48	52.000	0°	#N/A	25	#N/A
Bridge (Lot 5)														
49 + 311 South	48	46	41	46	43	44	40	43	48	44.000	0°	48	25	PASSED
49 + 311 North	45	45	45	39	52	45	45	39	36	43.000	0°	47	25	PASSED
Pipe Culvert														
77 + 920	50	42	41	41	40	43	41	40	43	42.000	0°	45	25	PASSED

*Source: Audit team field inspection results*

**Table 37: Stratified Random Sampling for the Eastern Corridor Road Lot 5 & 6**

Lot 5						Lot 6					
LHS			RHS			LHS			RHS		
32	41	42	43	44		75	85		86	87	88
29	40	39	38	37		72	84		83	82	81
26	33	34	35	36		69	77		78	79	80
23	32	31	30	29		66	76		75	74	73
20	25	26	27	28		63	69		70	71	72
17	24	23	22	21		60	68		67	66	65
14	17	18	19	20		57	61		62	63	64
11	16	15	14	13		54	60		59	58	57
8	9	10	11	12		51	53		54	55	56
5	8	7	6	5		48	52		51	50	49
2	1	2	3	4		45	45		46	47	48
						42	44		43	42	41
						39	37		38	39	40
						36	36		35	34	33
						33	29		30	31	32
						30	28		27	26	25
						27	21		22	23	24
						24	20		19	18	17
						21	13		14	15	16
						18	9		10	11	12
						15	8		7	6	5
						12	1		2	3	4

Source: Audit team worksheet

**Table 38: Non-Destructive Schmidt Hammer Test Result Sheet for some concrete structures on the Oil and Gas Enclave Roads**

GHANA AUDIT SERVICE TECHNICAL AUDIT FIELD CHECKLIST														
NON-DESTRUCTIVE SCHMIDT HAMMER TEST RESULT SHEET														
▲	TESTED BY: Samuel D. Aidoo										DATE:	6-May-19		
TITLE:	TECHNICAL AUDIT OF SELECTED ROADS IN GHANA													
▼	NAME OF PROJECT: Oil and Gas enclave roads										ROAD	Oil and Gas enclave roads		
LOCATION OF STRUCTURE	SCHMIDT HAMMER TEST READINGS (NB: impact points should be at least 20 mm apart)									ADJUSTED AVERAGE READING	TEST ANGLE (0°/90°/270°)	PROBABLE STRENGTH (N/mm²)	SPECIFIED STRENGTH (N/mm²)	REMARKS
	1	2	3	4	5	6	7	8	9					
2x2 Box Culvert (HW inlet)	41	43	41	41	44	41	40	43	40	41.000	0°	44	30	PASSED
2x2 Box Culvert W/W Approach inlet	42	38	41	39	39	40	37	42	39	40.000	0°	42	30	PASSED
Bridge Abutment Approach	44	51	52	50	41	44	43	49	48	47.000	0°	52	30	PASSED
1.2 double pipe culvert H/W	39	41	42	35	42	38	47	47	42	42.000	0°	45	30	PASSED
1.2 double pipe culvert approach W/W	33	33	32	36	33	40	39	35	34	35.000	0°	35	30	PASSED

Source: Audit team field inspection results



# **Mission Statement**

**The Ghana Audit Service exists**

## **To promote**

- **good governance in the areas of transparency, accountability and probity in Ghana's public financial management system**

## **By auditing**

- **to recognized international standards and reporting our audit results**

## **And**

- **reporting to Parliament**

