



Research Article

Comparison of Stability Analysis of Rockfill Dams with Vertical and Inclined Clay Cores: A Case Study of the Middle Awash Dam, Ethiopia

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Abstract

This study conducted slope and seepage stability analysis of a rock fill dam by comparing the clay core geometry. The core geometry in this study has been changed from a vertical to an inclined arrangement, and all analyses have been conducted are compared with the original design. The geometry of the inclined clay core dam was fixed and checked for static loading conditions. The analysis has been conducted using numerical modeling software called GEO-Studio 2012. Based on calculations, the flux through the dam with an inclined clay core is $0.0057 \text{ m}^3/\text{sec}$, while the flux from the original dam with a vertical core is $0.0073 \text{ m}^3/\text{sec}$. The safety factors for the downstream slope during steady state, sudden drawdown, end of construction, and the construction stage are 1.72, 1.56, 1.53, 1.64, and 1.59, respectively. These values were obtained from the original dam design with a vertical clay core, and the corresponding safety factors are 1.63, 1.54, 1.63, and 1.57, respectively. Therefore, the geometry of the clay core is considered safe based on the allowable limit factor of safety and seepage. In addition to this, the inclined clay core section was found to be significantly more Economical compared to the vertical clay core.

Keyword

Embankment, Stability Analysis, Awash Dam, Material Properties, Clays, Cores

1. Introduction

Embankment dams, which are constructed using earth and rock fill material, are commonly referred to as embankment dams or filled dams. About 63 countries in the world are currently associated with dams that have a height greater than 15m, which are referred to as high dams (Njiru and Siriba 2018). Among these, more than 70% are embankment dams. Building such dams is extremely significant for evolving countries like Ethiopia, which have not fully utilized their water resources to the required level. Nowadays, numerous embankment dams are in the design and construction phases

across the country. However, the industry faces many challenges in terms of design and construction perspectives, because of the nature of the varying foundation condition and the range of properties of the material available for construction [2] and [16].

The selection of the most suitable type of dam for a specific site requires careful evaluation of the characteristics of each type, taking into account the physical features of the site and its intended purposes, as well as safety, cost-effectiveness, and other relevant constraints. The final decision on the type of

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dam should be made after considering all these factors [4] and [18].

The choice between natural and artificial sealing is made mainly in respect of the availability of material and the cost of its processing, hauling, dumping and compacting. All dams designed and according to current standards will have acceptable factors of safety [19]. The task is to find the most appropriate type, considering all technical and economic aspects and taking into account the actual details of the site [13].

The availability of critical construction materials such as cement, aggregate, sand, and filter drainages also play a significant role in determining the type of dam to be selected [18]. Topography is also a significant factor in the selection of a dam. Narrow gorges with U and V shapes are favorable for gravity or arch dams, while wide and flat terrains are best for embankment dams [20] and [6].

Embankment dams with a vertical clay core have an advantage. The core has a relatively small effect on embankment slope stability because it is located deep inside the embankment. Additionally, the possibility of contact seepage between the core and the foundation is reduced due to the high contact pressure at this location [17]. El-Infefiennillo (Mexico, 148m high), is among the tallest dams with vertical clay core arrangements [3] and [22]. In Ethiopia, this type of core arrangement is common and widely used. Most dams in Ethiopia with natural sealing follow this design. Those dams are. Tendaho, Gidabo, Ribb, Megech, Kesem, Welkite, Gilgel Abay, Jema, and Wolkayt Rock Fill Dam [8] and [16].

The impervious clay zone of an embankment dam has lower shear strength than the shell zone. Therefore, the location, width, and inclination of this zone has a significant effect on the stability, seepage control, and deformation characteristics of the embankment [7]. Clay core zones in embankment dams may have either vertical or inclined geometry depending on the site conditions [14] and [8]. The vertical core is arranged in a more or less symmetrical manner along the dam axis. These types of core arrangements in the design and construction of embankment dams are common, and many dams with such core arrangements have been constructed worldwide [1].

Depending on the specific advantages of the site, the core geometry might be designed to be sloping. The inclined core arrangement has several advantages over the vertical core in terms of shear stress concentration, plastic yield point, and resistance against hydraulic fracturing during sudden reservoir fill-up [17] and [20]. Embankment dams with an inclined clay core geometry are common and widely used in other countries. Dams with this geometric arrangement have the advantage of a higher factor of safety for upstream slope failure, estimated at approximately 50%. Most inclined clay core dams can be constructed as heterogeneous structures, and foundation grouting can be conducted concurrently with the construction of the downstream shell. This design also provides improved performance and resistance to earthquake loading [12].

Some studies [12] and [17] concluded that embankment

dams with inclined cores are preferable for seismic load conditions when the dam foundation has a steep slope (0.75H: 1V) along the river, there is a relatively impervious and strong foundation upstream of the dam axis, and the dam is being constructed in a highly seismic zone. They further stated that different construction processes are required for the placement of inclined core and shell materials. Orville Dam, which is 235 meters high in the USA, and Salto Santiago dam, which is 80 meters high in Brazil, are two of the largest earth-rock fill embankment dams with an inclined core arrangement [10] and [11].

With the exception of the coffer dam of the Tendaho dam project (Ethiopia Construction Design and Supervision Work Corporation 2007-2016), no major embankment dam with a similar core geometry has been constructed in Ethiopia. Many researchers have studied various issues associated with inclined core geometry and have introduced specific characteristics and their advantages. [15] and [7], and have numerically investigated the performance of clay core arrangements in earthen dams. A typical cross section of an embankment dam was used for investigation and four different core arrangements were analyzed: a vertical clay core, a 200 inclined core facing upstream, a 400 inclined core facing upstream, and a clay blanket on the upstream slope face.

The study [17] have also studied the effect of clay core shape on the stability of an embankment dam. These researchers conducted their study on the Ghavoshan rock fill dam, located in western Iran. The study considered the design of three different cores: a vertical clay core; a moderately sloping clay core (2.5H: 1V); and a steeply sloping clay core (0.75H: 1V). A numerical model of SIGMA/W has been used for the analysis. Deformation, stress distribution, and resistance to hydraulic fracturing have been considered as comparative parameters. Based on the investigation, the researchers found that the dam with a steeply sloping core (0.75H: 1V) has perform better in terms of embankment deformation and resistance to hydraulic fracturing.

The finite element method has been applied by [5] and [15] to analyze the Hongxing earth dam in Taiwan, which has an inclined clay core. Stress distribution and dam deformation were the major parameters studied in this research, and it was found that inclined core embankments have better performance in terms of deformation than vertical clay core embankments. After studying the economic benefits of an inclined clay core in the earth dam of Hongxing dam, it has been concluded that this structure is both economical and safe. It is reliable and meets all the design requirements.

L ópez-Querol, S. et al. [15] studied the performance of heterogeneous earth-fill dams under earthquakes and the optimal location of the impervious core. An investigation was conducted on a typical heterogeneous fill dam, and a finite element numerical code was used for analysis. Liquefaction potential, soil degradation, and crest settlement were the main parameters investigated. Based on the study, it was found that the dam with a higher core slope had better performance. The

researcher recommended that the location of the core material should be considered as a design criterion.

Therefore, the idea of investigating the Middle Awash dam by modifying the geometry of the impervious zone is supported by all the aforementioned studies on the geometry and arrangement of clay cores. Additionally, no significant dam with this type of core arrangement has yet been planned or constructed in Ethiopia, so designers should consider this when designing the dam.

According to the detailed design report for the Middle Awash multipurpose dam (ECDSWC, 2016), the dam core is planned to be constructed on fault breccia, which is unsuitable as a core foundation unless extensive foundation treatment, such as jet grouting, is performed. Furthermore, the borrow area designated for the impervious zone is located more than 15 km from the dam site, making the hauling distance considerably costly compared to other fill material locations. Consequently, the project is expected to incur significant additional expenses due to the need for extensive foundation treatment of the fault breccia with jet grouting and the absence of suitable clay material within a reasonable hauling distance.

2. Materials and Method

2.1. Details of Middle Awash Dam

The Middle Awash Dam is located between the Oromia and Afar National Regional States. The dam site is 15 kilometers from the borrow area designated for the core material. The proposed dam site can be accessed via the main asphalt road that runs from Addis Ababa to Djibouti (ECDSWC, 2016). According to the Middle Awash multipurpose dam's detailed design report (ECDSWC, 2016), the dam core is planned to be positioned on fault breccia.

However, it is not acceptable to use fault breccia as a core foundation unless extensive foundation treatment, such as jet grouting, has been performed. Since transporting large quantities of clay core material from the borrow area—located more than 15 km from the dam site—is not cost-effective, jet grouting of the fault breccia foundation is necessary, which increases project costs.

2.2. Location of the Study Area

The project of the study is located in Awash River Basin with geographic coordinates of Universal Transverse Mercator (UTM) of 990798m Northing and 629786m Easting at the center of the dam site. The location of the project area is shown in Figure 1.

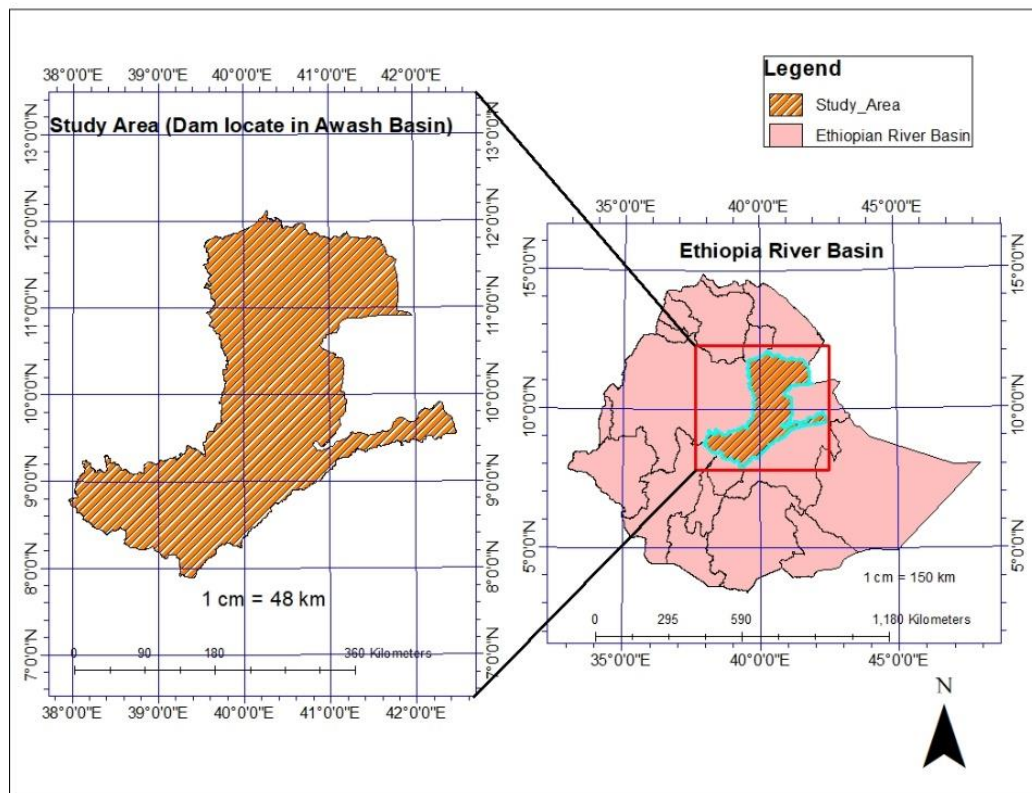


Figure 1. Location Map of the Study Area or project.

2.3. Data Collection

The maximum dam cross-section of the original design (central vertical clay core) prepared by water works design and supervision enterprise (ECSDWC, 2016) (Figure 2) are

shown below.

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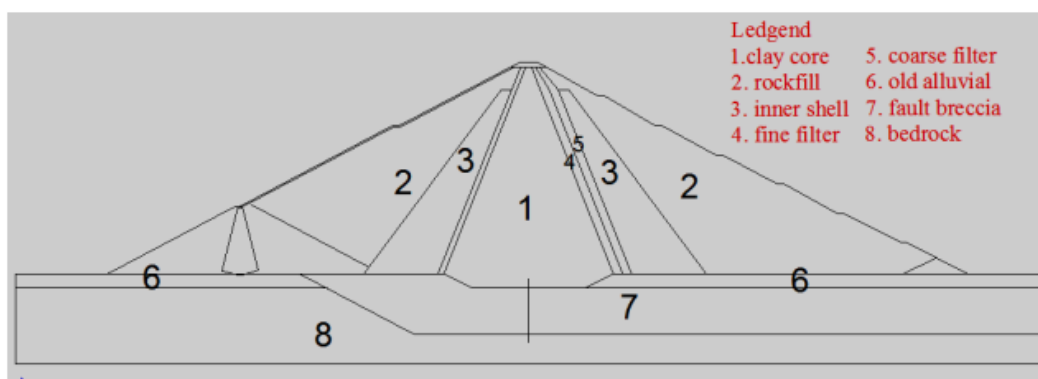


Figure 2. Middle Awash Dam Vertical Clay Core Geometry.

The other data was collected from Ethiopia construction design and supervision works corporation organization (ECDSWC, 2016) and Geo Studio software manual document. The collected data was presented as Table 1.

2.3.1. Parameters Used for Seepage Analysis

Table 1. Permeability coefficients used in the analysis (ECDSWC, 2016).

0	Permeability (m/sec)	Remark
Fine filter	4.76×10^{-8}	Design Report ECDSWC 2016
Coarse filter	7.9×10^{-5}	Design Report ECDSWC 2016
Inner shell	0.05	Design Report ECDSWC 2016
Rock fill	0.05	Design Report ECDSWC 2016
Old Alluvial	1.0×10^{-5}	Design Report ECDSWC 2016
Fault Breccia	1.33×10^{-5}	Design Report ECDSWC 2016
Foundation Bed Rock	1.0×10^{-9}	Design Report ECDSWC 2016

Table 2. Volumetric water content of embankment material [21].

Material	SVWC	Remark
Clay Core	0.5	SEEP/W sample function
Fine filter	0.35	SEEP/W sample function
Coarse filter	0.28	SEEP/W sample function
Inner shell	0.27	SEEP/W sample function
Rock fill	0.25	SEEP/W sample function

2.3.2. Parameters Used for Slope Stability Analysis

Table 3. Shear strength parameter used for analysis (ECSDWC, 2016).

Material	Unit Weight (KN/m ³)	C' (kpa)	ϕ' (degree)	Remark
Clay core	16	20	23	Design Report
Fine filter	20	0	32	Design Report
Coarse Filter	20	0	34	Design Report
Inner shell	20	0	34	Design Report
Rock fill	22	0	42	Design Report
Old Alluvial	20	5	34	Design Report
Fault Breccia	17	10	34	Design Report
Foundation bed rock	Bed Rock	Bed Rock	Bed rock	Design Report

Table 4. Pore water pressure ratio (ru) values for construction condition [9].

Material	Pore- water pressure ratio (ru) at during construction	Pore- water pressure ratio (ru) at After construction
Clay core	0.45	0.4
Old Alluvial	0.35	0.3
Fault Breccia	0.35	0.3

2.4. Materials and Methods

For this study, Geo-Studio 2012 package was used for analysis and from the tools of software, the first two: SEEP/W, and SLOPE/W was used depending up on the problem to be examined. The intent of this study is to prepare an inclined clay core and compare with vertical clay core. Thus, the study was included: -

2.4.1. Dam Dimensioning

An intensive literature review on embankment dam design was carried out to determine appropriate dimensions and zoning of an alternative design.

2.4.2. Seepage Analysis

SEEP/W is a finite element based GEO-STUDIO component, used for seepage analysis. It is used for modeling of

movement of water and pore water distribution through a pore's media such as soil and rocks. This research will carry out both steady and transient seepage analyses to determine the amount of water flows (flux) passing through the embankment, to calculate the pore water pressure inside the embankment which is used as an input for the stability analysis of different loading conditions [9].

2.4.3. Slope Stability Analysis

For slope stability analysis SLOPE/W which is a component of Geo-studio (GEO-SLOPE International Ltd 2012) will be used and it has been designed and developed for analysis of stability of slopes. According to [23] the minimum factor of safety with respect to loading condition has been shown in the following Table 5.

Table 5. Minimum required factor of safety versus loading condition.

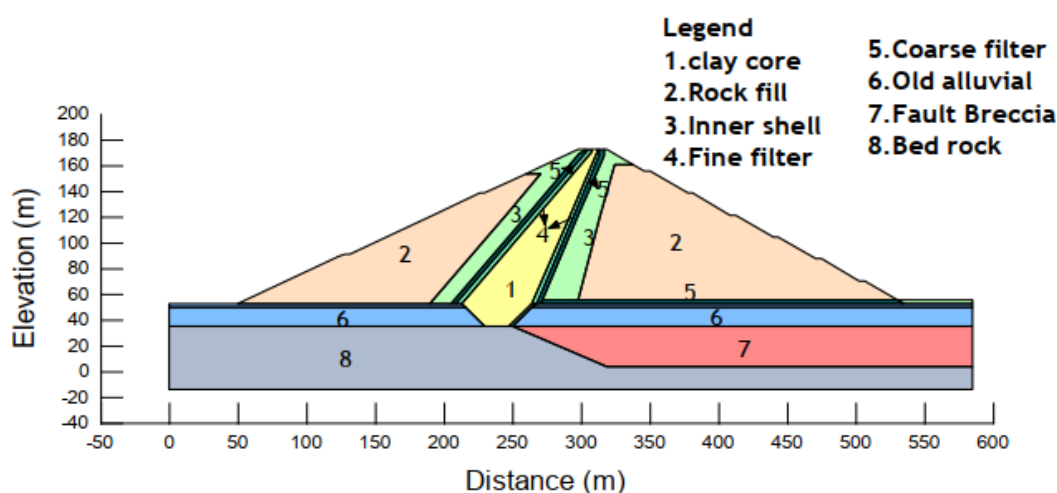
Slope	Load condition	Reservoir characteristics	Minimum factor of safety
Upstream and down stream	End of construction	Reservoir empty	1.3
Downstream	Steady state seepage	Reservoir at normal maximum operating level (full supply level)	1.5
Downstream	Maximum flood	Reservoir at maximum flood level	1.5, free draining crest zone, 1.3 other wise
Upstream	Drawdown	Rapid drawdown to critical level	1.3

3. Results

3.1. Dam Zoning and Geometry

The inclined clay core dam cross section has been amended the slope of the outer shell with a ratio of 2H: 1V for upstream and 1.6H: 1V for downstream has been selected. This dam geometry includes 6 downstream berms and 2 upstream berms,

each with a width of 4m. A core top width of 3m has been provided for the operation of building apparatus. And considering the actual site conditions, including the location of the fault breccia's zone and economic factors, a clay core slope of 1V: 0.8H and 1V: 0.4H have been selected for the inclined clay core upstream and downstream respectively. The maximum dam cross-section of the modified dam cross-section with an inclined clay core (Figure 3) are shown below.

**Figure 3.** Inclined Clay core Dam Geometry.

In Figure 3, the old alluvial soil is present both upstream and downstream of the dam. Dam in Alluvial Foundation: Erosion of fine-graded soils through seepage can cause piping. It will result in differential settlement and seepage of the dam. Therefore, in an inclined clay core, the old alluvial soil has to be considered during analysis.

3.2. Comparison of Seepage Analysis

The number of finite elements has been adjusted based on the recommendation given by [21] engineering book where each discretized elements are clearly visible on (Figure 4).

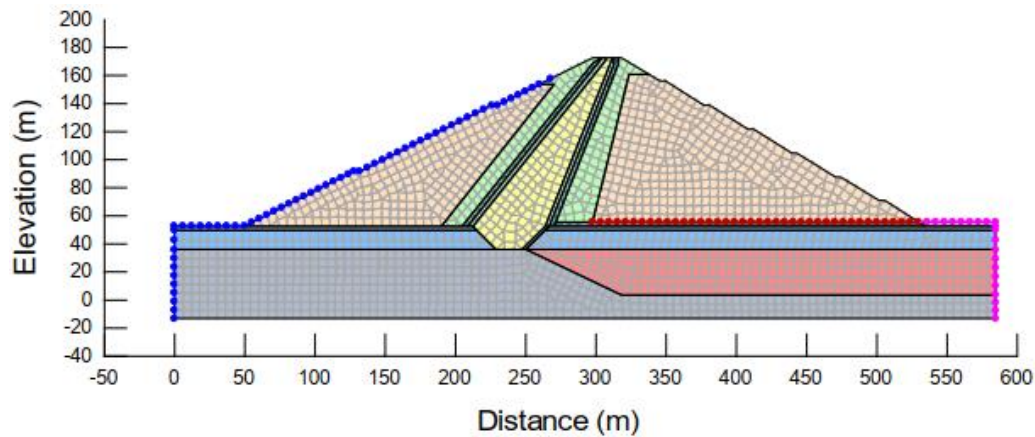
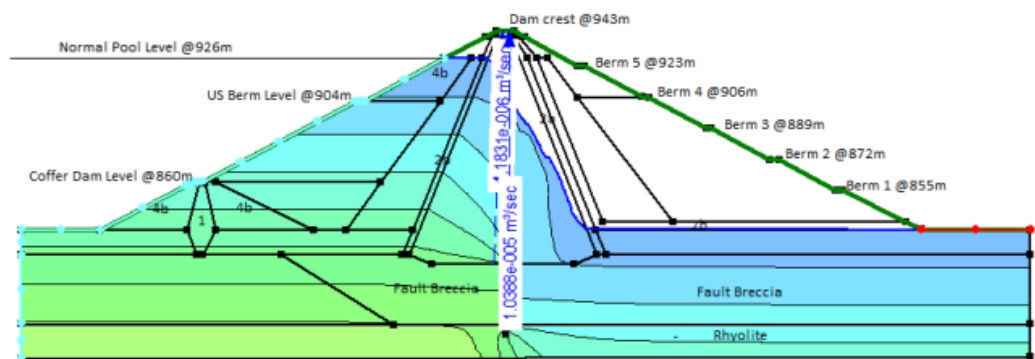


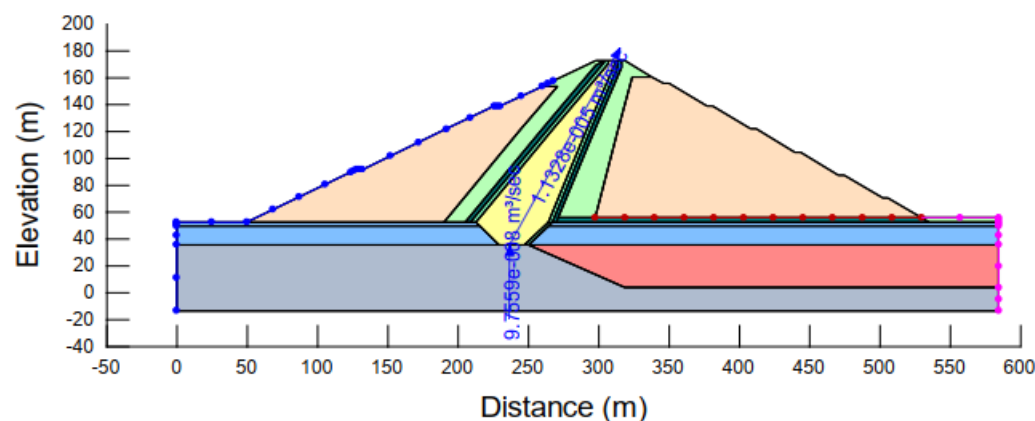
Figure 4. Finite element discretization and boundary condition applied for seepage analysis.

The flux through the dam body and the foundation has been computed for inclined clay core. Based on the computation, the total flux through the dam body and foundation is estimated to be $1.143 \times 10^{-5} \text{ m}^3/\text{sec}/\text{m}$. Among the total flux found, a flux of $9.76 \times 10^{-8} \text{ m}^3/\text{sec}/\text{m}$ flows through the dam foundation, and $1.133 \times 10^{-5} \text{ m}^3/\text{sec}/\text{m}$ flows through the dam body (Figure 5B). Considering the crest length of the Middle Awash dam to be approximately 500m, the total volume of water

seeping through the dam body and the foundation is estimated to be $0.0057 \text{ m}^3/\text{sec}$. For Comparison, the flux quantity calculated on the vertical clay core design prepared by the Ethiopia Water Works Design and Supervision Enterprise (ECDSWC, 2016) is $1.04 \times 10^{-5} \text{ m}^3/\text{sec}$ and $4.18 \times 10^{-6} \text{ m}^3/\text{sec}$ through the foundation and dam body respectively (Figure 5A) so that the total volume of water seeps through the dam is expected to be $0.0073 \text{ m}^3/\text{sec}$.



A



B

Figure 5. A. Flux thorough dam body and foundation for Vertical core (ECDSWC, 2016) and B. For inclined clay core.

The hydraulic gradients are computed in the dam body and foundation for the Inclined core and the result varies in the range of 0.5 to 3.5 (Figure 6). The vertical gradient inside the dam body and the foundation has varies between the ranges of 1.81×10^{-7} to 3.15×10^{-7} .

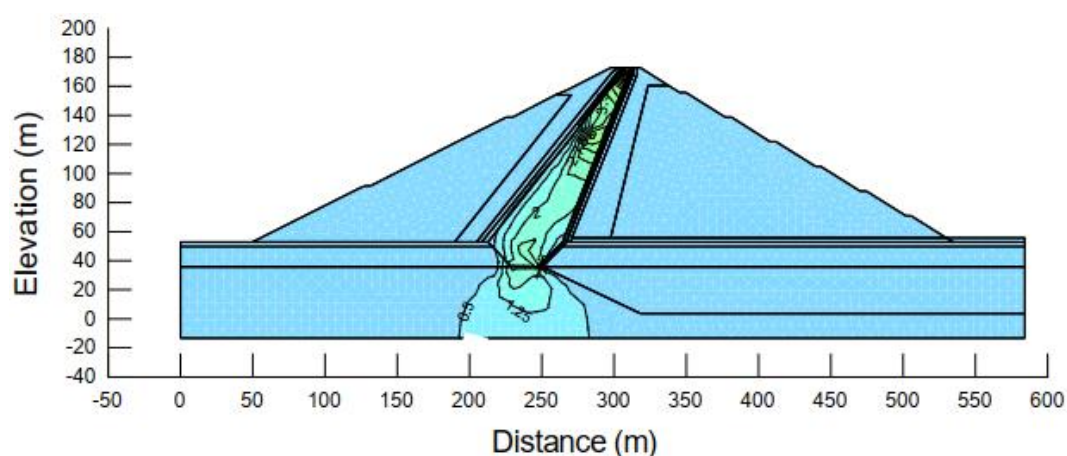


Figure 6. Contours of horizontal gradient through dam body and foundation.

3.3. Comparison of Static Slope Analysis

3.3.1. Steady State Condition

The downstream embankment slope for both the vertical and inclined core options has been analyzed for steady state conditions when the reservoir is at normal pool level. A minimum factor of safety for inclined slopes was obtained from

Geo-studio 2012 using a variety of analysis methods and comparison with the vertical clay core results, is presented in Table 6 (ECDSWC, 2016). The factor of safety has been improved for the alternative due to the fact that the majority of the material with high shear strength is located on the downstream side, as a result of the inclination of the core material towards the upstream.

Table 6. Factor of safety of downstream slope at steady state condition.

Methods	Factor of Safety		
	Vertical clay core	Inclined Clay Core	Allowable limit
Morgenstern	1.63	1.72	1.5
Ordinary	1.59	1.69	1.5
Bishop	1.63	1.72	1.5
Janbu	1.59	1.69	1.5

3.3.2. End of Construction

The stability of both upstream and downstream slopes during end of construction has been analyzed and a minimum factor of safety was presented in Table 7.

Table 7. Factor of safety both upstream and downstream slope at End of construction.

Methods	Factor of Safety				Allowable limit
	Vertical clay core		Inclined Clay Core		
	D/S	U/S	D/S	U/S	
Morgenstern	1.63	1.5	1.69	1.53	1.3
Ordinary	1.62	1.49	1.67	1.52	1.3
Bishop	1.62	1.5	1.64	1.53	1.3
Janbu	1.61	1.49	1.66	1.53	1.3

3.3.3. Construction Stage

Based on the computation, the minimum factor of safety during construction stage is presented in Table 8. For the downstream and upstream respectively.

Table 8. Factor of safety both upstream and downstream during construction stage.

Methods	Factor of Safety				Allowable limit
	Vertical clay core		Inclined Clay Core		
	D/S	U/S	D/S	U/S	
Morgenstern	1.63	1.57	1.501	1.59	1.3
Ordinary	1.6	1.55	1.5	1.6	1.3
Bishop	1.6	1.55	1.5	1.6	1.3
Janbu	1.61	1.56	1.5	1.61	1.3

The upstream slope for revised design has been found to have a slight improved factor of safety as compare to the Vertical clay core and the downstream slope have a relatively less factor of safety as the downstream embankment slope because of relatively steeper. But the margin of safety computed for both upstream and downstream are still more than adequate when as compared to the minimum requirement suggested by to [23]. Furthermore, the mass of the downstream embankment slope potentially subject to failure is small and manageable.

3.3.4. Sudden Draw Down

During a sudden drawdown, the stabilizing effect of the water on the upstream face is abruptly lost, but the pore water pressures within the embankment may still remain high. As a result, the stability of the upstream face of the dam will be significantly reduced. During sudden drawdown conditions,

materials with high hydraulic conductivity drain quickly, while materials with low hydraulic conductivity take a long time to drain. Therefore, a transient (time-dependent) analysis is required. For this study, it is assumed that the core material will have a slow drainage rate, while the other embankment materials will have a free drainage rate. Basically, to perform a transient seepage analysis, two sets of boundary conditions are required: an initial boundary condition and a transient boundary condition [10]. Initial boundary conditions are required to define pore water pressures throughout the model at the beginning of the transient analysis. For this analysis, the initial boundary condition is taken from the SEEP/W result, which shows a total head on the upstream embankment slope equal to the reservoir level at the initiation of drawdown. The initial pore water pressure required just before sudden drawdown has been obtained from the steady state condition. The minimum factor of safety during sudden drawdown in both inclined and vertical clay cores was presented in Table 9.

Table 9. Factor of safety of Upstream slope during sudden drawdown.

Methods	Factor of Safety		
	Vertical clay core	Inclined Clay Core	Allowable limit
Morgenstern	1.54	1.464	1.3
Ordinary	1.34	1.42	1.3
Bishop	1.54	1.464	1.3
Janbu	1.42	1.44	1.3

3.5. Economical Comparison

For both the inclined clay core design and the vertical clay core design, an economic comparison of the Middle Awash dam's main operations has been calculated. The volume of the rock fill zone has resulted in an additional cost of 2.2 million US Dollar based on the estimated work quantity for the Embankment of vertical clay core geometry. An inclined clay core worth millions of US dollars. The cost of the inner shell

and compacted clay core with special treatment work on the core foundation, however, could be lowered by 5.4 million US dollars in the case of inclined clay core geometry compared to the vertical clay core, which is the total of the inner shell and clay core. As shown in Table 10, the inclined clay core has resulted in a savings of 3.2 million US dollars on the project from embankment work alone. In comparison to the vertical clay core geometry, the inclined clay core project cost has been lowered by 3% overall.

Table 10. Variation of activities due to clay core zone change.

Activity No	Description	Unit	Rate in USD	Quantity Variation		Amount in USD
				Addition	Omission	
1	Embankment work					
1.1	Compacted Rockfill	m3	17.12	130011.1		2,225,790.032
1.2	Compacted Inner shell	m3	6.54		-101937	-666,667.98
1.3	Compacted clay core	m3	7.82		-603033.3	-4,715,720.41
	Net Amount					-3,156,598.35

4. Discussion

The Middle Awash Dam was initially designed as a rock-fill dam with a vertical clay core, as previously discussed in this document. Due to the presence of fault breccia in the foundation, this design requires special treatment for the core's foundation (ECDSWC, 2016). To address this issue, an alternative approach was adopted by changing the core geometry from vertical to inclined, thereby eliminating the need for construction directly on the fault breccia. All necessary analyses have been conducted for this new clay core configuration.

A definitive evaluation of dam safety cannot be obtained

solely from the rate of water flow through the dam body and foundation. Nonetheless, seepage through the embankment must be kept under control to the necessary degree. If the right filter material, drainage system, and relief wells are used, a leakage of 0.03 m³/sec through the embankment and dam foundation is usually acceptable [13, 14]. The amount of seepage loss through the dam body and foundation determined in this study is within the permitted range when compared to this recommendation. Consequently, it is determined that the newly suggested dam cross section's capacity to hold water is adequate. The inclined clay in this study and the original design created by ECDSWC have different total flux results for the dam's body and foundation. This is mainly because, given

the limited supply of clay material within a reasonable transportation distance, the core thickness in this study is minimized to achieve maximum cost-effectiveness. As a result, while still satisfying the design specifications, the flow through the core is comparatively higher. Due to modifications, the flux calculated through the foundation for the inclined clay core is 9.76×10^{-8} m³/sec/m, which is significantly less than the original design calculated by 4.18×10^{-6} m³/sec/m (ECDSWC, 2016).

The risk of material erosion and piping is related to the hydraulic gradient inside the dam body. As a result, the hydraulic gradient at the interface between the core and the foundation and the core and the transition material must be regulated. It is advised that the hydraulic gradient for inclined core embankment dams not be greater than 4 [13] and [23]. As a result, the calculated hydraulic gradient in this work complies with requirement I. The e. the interval between 0.5 and 3.5. Additionally, the vertical gradient within the foundation and dam body is significantly lower than the permitted exit gradient of 1 i.e. the 1.81×10^{-7} to 3.15×10^{-7} . In order to prevent soil boiling and erosion on the dam foundation.

The inclined clay core section of the dam with the vertical clay core satisfies the minimum requirements under all loading conditions, according to the analysis that was done. The Morgenstern, Ordinary, Bishop, and Janbu method was used to perform the slope stability analysis. The slope stability analysis was carried out at various phases of construction, such as the end of construction, steady state condition, and sudden drawdown, based on the results obtained. It was found that all methods were safe when compared to the minimum allowable factor of safety set by the [23]. Therefore, the slope of the dam is safe in both vertical and inclined clay core geometry.

Geo Studio software results for the inclined core and (ECDSWC, 2016) for the vertical core indicate that the dam is safe against slope and seepage. However, because the thickness of the clay core is less than that of a vertical core, inclined clay core geometry is more cost-effective. The clay core becomes more appropriate for preventing seepage as its thickness increases. This study has demonstrated that the inclined clay core geometry is safe from seepage when the clay core thickness is thinner.

5. Conclusion

According to the Middle Awash dam's static analysis, changing the core geometry from vertical to inclined results in the following outcomes:

- 1) The amount of seepage through the dam body and foundation is found to be within acceptable limits compared to the standards.
- 2) It has been discovered that the downstream slope is stable under all loading conditions, including steady state conditions, the end of construction, and during construction.

- 3) The standard's minimal requirement is met by the factor of safety under all loading conditions. In a similar vein, it has been discovered that the upstream slope is stable under all loading conditions, including sudden draw-down, the end of construction, the construction stage, and during construction.
- 4) The minimum requirement recommended by the standard and guidelines is satisfied by the factor of safety under all loading conditions.
- 5) Additionally, the incline is based on the economic analysis of the project's primary Embankment work activities.

Abbreviations

ECDSWC	Ethiopia Construction Design and Supervision Work Corporation
U/S	Upstream
D/S	Downstream

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I would like to thank the project team workers of Ethiopian Construction Design and Supervision Work Corporation for providing me with detailed information about the dam.

Author Contributions

Chimdesa Regasa Kishe: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Resources, Software, Validation, Writing – review & editing

Data Availability Statement

Data cannot be made publicly available; reader should contact the corresponding author for details.

Conflict Interest

I declare that this title has no any conflict interest.

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