Hydrology, Irrigation, and Civil Engineering

Portfolio

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H&S Engineers

Brief Self-Introduction

- Born and raised in a building contractor's family, I had been introduced to construction sites early on. The regular visits to dad's construction sites elevated my curiosity about the field of engineering. Later, I went to engineering college, studied Civil Engineering with additional courses for irrigation engineering projects, such as dam, canal, and infrastructure construction, and received a degree in 1996. Then, after years of work experience, I carried on studying and received a master's degree in engineering hydrology in 2005. On top of that, I received additional training and took part in more advanced research at higher academic institutions as a collaborator and Ph.D. student. The universities I attended include *The University of Arba-Minch,* Ethiopia, *The University of KwaZulu-Natal*, South Africa, *Central University of Technology*, South Africa, *The University of Fribourg,* Switzerland, and *The University of Applied Science and Arts Western Switzerland,* Lausanne, and at the EPFL and UNIGE. I have also studied French language courses at, *IFAGE*, *The University of Fribourg*, and *The University of Geneva*, Switzerland. Besides, I attended various brief professional training courses that include 6 months Series of Water Management Courses conducted by *the Natural Resources Conservation Service of USA (NRCS),* 10 days of ArcGIS and GPS integration training conducted by *the University of Bern,* Switzerland, and 3 days of Water Resources Yield Model (WRYM-IMS Model) introductory course conducted by *the Department of Water Affairs and Forestry of South Africa*.
- In my practical work experiences, I took part in various engineering assignments and gained experience regarding design hydrology, catchment studies, flood routing, building construction, irrigation infrastructures, and small-scale earth dam construction as well as other relevant water resources projects.
- Simultaneously, I have enriched and enhanced my proficiency in using engineering instruments and software programs. Consequently, I can utilize engineering instruments such as Total-station, Theodolites, and drone surveying and mapping. Moreover, able to employ engineering software packages such as Revit 3D modeler, AutoCAD, ArcGIS, HEC-RAS, HEC-HMS, Bentley Software program (civil-storm, pond pack, Flow master, and others), IDRISI, PCI-Geomatica, and others.
- At present, I am convinced that I have the essential proficiency to take part in prominent engineering undertakings that may incorporate hydrologic design, dam, and irrigation infrastructure as well as building construction supervision.

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Values and Work Philosophy

Acquiring knowledge of engineering is an opportunity. It is an opportunity to resolve problems and add value to communities. In order to play a role proficiently and responsibly, rigorous training programs are necessary to acquire engineering skills.

In addition to having theoretical and fundamental technical backgrounds, I believe visualization talent is also vital to engineers. Competencies such as rational thinking, environmental consciousness, and ethical awareness are other aspects that are required to be mastered.

As an engineer, my task would be to utilize my skills with due diligence and accountability to play a role in contributing towards the progress and advancement of human society.

Reflection on Professional Development

Schools help with acquiring knowledge and methodologies to help solve problems in the real world. Moreover, practical experiences have also a lesson to teach. Through years of practical experience, I have developed not only my skills but also my confidence has gotten consolidated tremendously. As a result, successive projects were done with ease and more efficiency.

From being a participant in construction projects, I had gotten opportunities to lead projects, trained staff members, evaluated projects in terms of feasibility and technical soundness as well as consult others to achieve their goals.

During the years, I have enriched my competencies and acquired tools that could help to facilitate tasks more efficiently. The more I took part in research and construction projects, the more courageous I became in decision-making and solving problems with ease.

Future objectives:

My long-term ambition and explorations lie in mastering more computer applications to harness water resources proficiently to alleviate future water shortage crises and happy to participate in any civil engineering projects that may benefit society.

Project 1

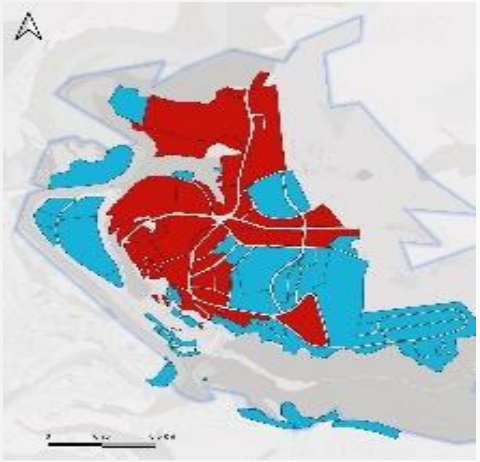

Figure 1 Noise pollution, Schoenberg, Fribourg.

Description:

- **Name of the Project**: Urban Planning Project (Analyses of *Noise pollution in Geneva city*, estimating t*ransportation access to a commune or a village*, measuring the time it takes to access a *supermarket*, etc
- **Location:** Geneva and Fribourg City, Switzerland
- **Enterprise:** Personal and group projects, at the University of EPFL and UNIGE

Period of Analysis: February - July 2021

I did participate in the urban planning program in 2021 at the university of EPFL and UNIGE and studied urban planning using different tools such as QGIS, and other 3D modeling software like Cinema 4D.

The goal was to analyze the Geneva city noise pollution, secondary and tertiary employment numbers in the city, and analyze supermarket facilities, hospitals, and other public facilities with the help of urban planning tools such as QGIS.

Details are shown at the following links:

- https://cv.hagoscon.com/my-qgis-adventure-in-2021/
- Project paper personal
- Project paper group

Implementation:	• The project was analyzed based on updated and real Federal and cantonal data.
Challenges :	• Learning the tools such as the QGIS software and mastering it in order to analyze the parameters stated above
Solution provided:	• I have studied the software and other urban planning tools in order to analyze Geneva city and Schoenberg city, Fribourg. The analysis was a success.
Major lesson learned:	• I aquired the skills and the tools to accomplish a task of an urban planning
Illustration:	• https://cv.hagoscon.com/my-qgis-adventure-in-2021/

Project 2

Description:

- Name of the Project: Galexis Avance Ecublens, 3D Building Modeling.
- Location: Lausanne, Switzerland
- Enterprise: CSD ENGINEERS Lausanne
- Period of Analysis: August - November 2019

Goal: The owners wanted to renew the building and wanted to place machines and other mechanical materials in it. In order to accomplish the task, it is necessary to develop a 3D model of the already-built building so that the mechanical engineers be able to place the machine inside of the 3D model. This helped them to visualize their design in a 3D virtual model.

I created a 3D model of a factory (Galexis Avance Ecublens, Lausanne) from a 2D model. In this project, there was a collaboration with an architectural office that designed machines inside of the 3D building I created. The machines inside the building are shown in the video link below.

In this project, my job was to convert the old 2D building model into a 3D model so that the mechanical engineers can design and show the machines in a 3D space. The whole project of the 3D model is shown at https://cv.hagoscon.com/portfolio/

Other similar building designs that I did in previous years are shown in the following link: https://cv.hagoscon.com/my-3d-modeling-adventure-with-revit/

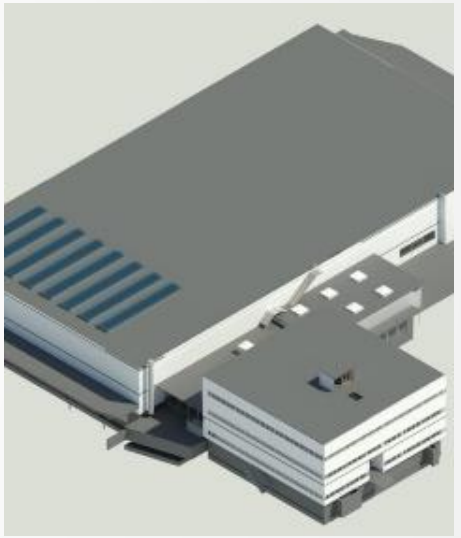

Figure 2 3D building model, Lausanne.

implementation:	• Revit 3D model of a factory building with all its sections and the surrounding parking area, and nearby buildings
Challenges :	• The challenge was to convert an existing 2D building model to a modern design using a 3D model software (Revit) so that technicians can use the virtual 3D space to design their technical materials in the building.
Solution provided:	• The solution provided was working in collaboration with a Revit Model. While I was creating the building, the other mechanical engineer used to insert his creation into the building. We collaborated with a BIM360 software that helps different professionals to collaborate and work on a project remotely at the same time, each one of us working our part in the project.
Major lesson learned:	• I learned how to collaborate remotely with software such as *Revit and BIM360, and* practiced other software such as *AutoCAD*, *Revizto 4, and Solibri.*
Illustration:	• *Galexis Avance Ecublen-Video*

Project 3

Figure 3. Aire River, Geneva.

Description:

- **Name of the Project**: HEC-RAS analyses of the Aire river, Geneva.
- **Location:** Geneva, Switzerland
- **Enterprise:** SECOE, Geneva
- **Period of Analysis**: January- March 2014

Goal: as the highest possible discharge that can be taken care of at the **Pont-Rouge** (tunnel entrance) is 60 m3/s, lowering the discharge below 60 m3/s is essential. The new construction work of the diversion structure reduced effectively the amount of discharge at the Pont-Rouge. The result of this HEC-RAS analysis has also demonstrated the same. The detail of the analyses is shown at https://hagoscon.com/project/hec-ras-analysis/

Around 5 km length of the river was analyzed using the HEC-RAS model and the design discharge or the maximum discharge at the Bridge (Pont-Rouge) was estimated.

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implementation:	• HEC-RAS model used to run different scenarios such as the recurrent interval years of 300, 100, and 10
Challenges :	• Making sure that the villages along the river “L’Aire” are safe by lowering the discharge of the river so that the tunnel at the Bridge “Pont Rouge” accommodates the incoming flood. Hence, overtopping and inundation of the commune could be avoided.
Solution provided:	• Diversion of part of the river flows through the ***bypassing tunnel*** directly to the Rhone river in order to decrease the flow along it’s natural course. Hence, the safe discharge could be sent down to the village, and then to the Arve river.
Major lesson learned:	• 2D analyses of river flow using the HEC-RAS model
Illustration:	• *https://hagoscon.com/project/hec-ras-analysis/*

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Project 4

Figure 4. Assab Referral Hospital.

Description:

- Name of the Project: Construction of Assab Referral Hospital.
- Enterprise: Construction Department of the Southern Red Sea Region, Eritrean Defense Force (EDF) Assab, Eritrea
- Period of Construction: June 2000 – early 2006

The construction work incorporated ground plus one complex consisting of an outpatient building (OPD) and a 200-beds healthcare facility center. Besides that, there were additional service buildings. The surface area of the construction site was about 124 sq m.

Foundation: 1.5 to 2m deep spread foot foundation

The completed outpatient building (OPD) is shown in Figure 4

Implementation:	• Standard mortar and concrete mix utilized (B25): This is a mix ratio of cement: sand: gravel of 1:2:4, and • The slump test technique was employed.
Challenges :	• Excessive heat, and • Presence of excessive salt at the foundation.
Solution provided:	• The frequency of water cure increased, and concrete was usually covered with wet tissues, and • Sulfate-resisting cement was used for the foundation.
Major lesson learned:	• Project management, proficiency in surveying instruments, Techniques of transferring designs from paper to the ground and methodologies of building construction, and • Reclaiming more wasteland by applying certain kinds of technologies saves more land in populated regions.
Illustration:	• *https://hagoscon.com/project/assab-regional-hospital-construction/*

Project 5

Figure 5 Halhal dam construction, 1997

Description:

- **Name of the Project**: Halhal Small Scale Earth Dam Construction (Dam Mikilim).
- **Enterprise:** Ministry of Agriculture (MOA), Asmara, Eritrea.
- **Period of Construction:** February 1997 – June 1997.

Dam body:

- The Halhal dam was designed to be 17m high, crest length of 65m, crest width of 5m, and bottom width of about 90m. The core body of the dam was built with clay soil and the two opposite outer body surfaces were packed with dirt dug out from the reservoir area. The upstream and downstream slopes surface were 1:3 and 1:2 respectively. Both sides were covered with stone rip-rap. Moreover, the downstream side had a berm in the middle.

Spillway:

- The spillway was merely a dugout; it had around 10m width and around 1.5m depth. The length of the spillway extends to the downstream side of the existing river course. Consequently, the freeboard level of the dam was at level 15.5m from the bottom, or in other terms, the maximum depth of water was equivalent to 15.5m. The fetch length of the reservoir stretched out greater than 120m in the direction of the upstream reservoir boundary.

Outlet Structure:

- The outlet was made from a regular concrete pipe nevertheless protected or covered by a reinforced concrete cover. There were around 11 collars (7ms distances between each collar) along the pipe to help minimize seeping/ creeping water.

Gravel and Sand Filter:

- The downstream side toe of the dam had a sand and gravel filtration system that can help to discharge water off the phreatic line safely.

Implementation:	• Hand rammers and smooth rollers were utilized, and • Outlet structures were constructed using concrete pipe and reinforced concrete cover with standard mortar mix, B25.
Challenges :	• Lack of proper compaction machinery and soil tests were absent due to lack of a laboratory in the vicinity, and • Presence of excessive groundwater at the foundation.
Solution provided:	• Thumb rules were used to compact the soil, and • A pump is used to remove excess water from the foundation.
Major lesson learned:	• Project management, proficiency in surveying instruments, Techniques of transferring designs from paper to the ground and methodologies of earthen dam construction, and • Dams change the environment either positively or negatively depending on their location and size. Nevertheless, Halhal dam impacted the environment positively by providing water to the downstream irrigation farms and drinking water to their cattle. The current status of the dam can be seen in this *link*. Building ponds and small-scale dams should be encouraged to alleviate water shortage problems.
Illustration:	• *https://hagoscon.com/project/earth-dam-construction/*

Project 6

Figure 6 Canal drop structure

Description:

- **Name of the Project**: Adigudem Surface Irrigation Project (Gumselasa dam)
- **Enterprise:** Sustainable Agriculture and Environmental Rehabilitation in Tigray Region (SAERT). A semi-governmental institute and its main office were located at Mekelle city, in the northern Ethiopia region.

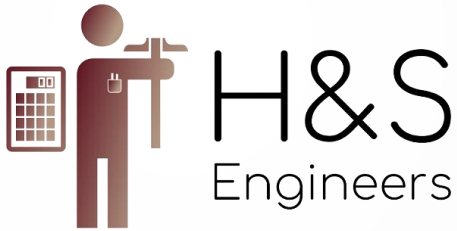
Period of construction: February 1996 – November 1996

The size of the irrigation farmland was 136ha and the method of irrigation employed for the farm was surface irrigation that comprised of primary/principal canal (trapezoidal), a secondary canal (trapezoidal), and tertiary canals (trapezoidal). The canals incorporated 400 concrete drop structures (canal falls) approximately with a size of 1-1.7 m height and 90- 1.20cms width and 0.3m thickness. The downstream and upstream sides of the drop structure had simple stone aprons (without mortar). There were two large drop structures with stilling basins at the downstream side and a concrete apron on the upstream side.

Figure 6 helps to conjure up the drop structure constructed at the Adigudem site. The image presented here is not the actual picture taken at the Adigudem irrigation site but a portrayal to visualize the structures constructed at the project.

Continuation…

Implementation:	• The canals were earthen canals, dug out in a trapezoidal shape, and • The drop structure, stilling basin, and turnouts were constructed using masonry and standard mortar mix, B25.
Challenges :	• Water loss due to seepage, and • Numerous localized rock formations along the canal.
Solution provided:	• Clay paddling to minimize the seepage, and • Rocks were excavated out and filled with clay soil and then re-dug in a trapezoidal shape.
Major lesson learned :	• Project management, proficiency in surveying instruments, techniques of transferring designs from paper to the ground and methodologies of earthen canal construction, and • Earthen surface irrigation canals lose lots of water to the ground through seepage and evaporation. The concrete lining is expensive either. Hence other efficient methods such as drip irrigation or sprinkler irrigation design should be considered to maximize efficiency.
Illustration:	• *https://hagoscon.com/project/surface-irrigation-project/*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