



THE REPUBLIC OF UGANDA
Ministry of Health

NATIONAL HEALTH LABORATORY INFRASTRUCTURE GUIDELINES

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The Department of National Health Laboratory and Diagnostic Services
Ministry of Health P. O. Box 7272, Kampala



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Foreword

Laboratories are an indispensable component of health care systems because they generate information necessary for diagnosis and management of clinical conditions, policy formulation, epidemics management in addition to their role in training and research.

Appropriate infrastructure is necessary for laboratories to produce quality laboratory results and to ensure safety of the health workers and the communities which are served by or where these laboratories are located. Inappropriate infrastructure compromises the quality of laboratory services and poses a serious risk resulting from misleading results and exposure to infectious and/or toxic materials from the work of laboratories.

While the Ministry has rallied various stakeholders in an effort towards improving the physical infrastructure of health laboratories across the country, construction, refurbishing and remodelling of health laboratories was not well guided in many instances partly due to lack of national guidelines hence compromising the quality of works. As a result, the infrastructure of many of the laboratories in the country still do not meet the basic requirements for safety and quality of the services provided.

The Ministry of Health has developed these guidelines to provide the basic national health laboratory infrastructure standards for all health laboratories at the various levels of health care which should be used as the first point of reference for any health laboratory construction, refurbishing and remodelling. The department of National Health Laboratory and Diagnostic Services shall support the infrastructure division of the Ministry of Health and the Allied Health Professionals' Council in implementing these guidelines.

Local Governments, Health Facility administrators, Development and Implementing Partners, and consultants shall use these guidelines during design, construction, inspection and commissioning of laboratories as the country looks to revamping the laboratory infrastructure.



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Director General Health Services

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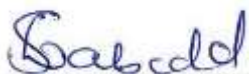
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1.0 Introduction:

Physical infrastructure is an essential component the laboratory quality management system. Laboratories are areas of aggregation and accumulation of potentially infectious biological agents, toxic chemicals and highly flammable reagents, and hence pose a potential risk to the personnel working therein, the community, as well as the environment. Design features enabling restricted access, adequate and safe work space, proper ventilation, ease of cleaning, controlled disposal of effluent and proper waste management help mitigate the infectious and chemical risk. Features to prevent, detect and fight fires limit the fallout from potential fire accidents. Ergonomic and aesthetic features such as lighting, finishing, provision for ample space and designs to accommodate work while standing or in sitting positions, provide a friendly work environment that motivates while minimizing potential injury to laboratory personnel in the course of their duties.

A well designed laboratory allows for proper workflow during testing procedure thereby minimizing errors, clutter and accidents while optimizing utilization of time. Provision of adequate space and power contributes to proper management of equipment and supplies thereby reducing interruption in service delivery.

Laboratory design should take into consideration the procedures, workload, equipment and number of personnel. In most cases, these depend on the level of care, with complexity increasing through the tiers from Health Centre III to National Referral Hospital.

According to the National Laboratory Biosafety and Biosecurity risk assessment survey of 2017 (Atek et al, 2017), more than 50% of laboratories surveyed did not conform to the national infrastructure standards for construction. Most had been designed inappropriately and lacked adequate space, proper ventilation, proper surfaces, running water, proper drainage and reliable power supply. In addition, facilities for incineration of laboratory waste were generally inaccessible, subsequently compromising laboratory safety.

The National Health Laboratory Policy of 2009 recognizes the importance of proper laboratory infrastructure in health laboratory service delivery. The policy states that ‘ All laboratory facilities shall have appropriate space and safe environment for personnel, patients and community’. As such, government in collaboration with various development partners have embarked on construction of a number of new health facility laboratories as well as refurbishment of existing ones. This proliferation in physical infrastructure improvement demands well directed and coordinated design and construction to ensure that they meet national standards.

GUIDELINES FOR CONSTRUCTION OF HEALTHCARE LABORATORIES IN UGANDA.

This document defines the standards that must be taken into account during designing and implementation of construction/renovation as well as commissioning of laboratories for various levels of care in Uganda. It is meant to guide laboratory professionals, architects, engineers and administrators involved in design, construction, refurbishment and commissioning of health care laboratories in Uganda.

2.0 Background

A strong laboratory infrastructure is very essential in the diseases diagnosis, monitoring, prevention, control and health emergencies. Uganda has over 1600 public laboratories ranging from the lowest to the highest level. Health Center III, Health Center IV, General Hospital, Regional Referral Hospital, National Referral Hospital and the National Institute for Research in Public Health. However, the infrastructure status for most of these laboratories are inadequate to sufficiently support testing at the level of the tier. The Maputo declaration on strengthening laboratory system, January 2008 recognizes that, several factors have resulted in inadequate laboratory systems to support the scale-up of programs in resource-limited settings, and inadequate infrastructure was one of the areas highlighted.

The MoH developed the national Health Laboratory policy 2016 and the laboratory strategic plan 2016 -2021 to guide the implementation of laboratory services in the country, each emphasized construction/renovation of health facilities and national infrastructure guidelines; however, the guidelines was drafted in 2012 and never finalized. The implementation through PEPFAR and other development partners (World Bank, Fleming Fund) have done a number of infrastructure projects and constructions in the country but there has been no national document on lab infrastructure to guide implementation. This document provides guidance on how laboratory infrastructure development should be planned, designed, implemented, monitored and evaluated. It serves as a useful resource for MoH, Implementing partners, private sector, and other stakeholders.

3.0 General Considerations for construction:

In this document, general considerations have been categorized into 6 categories; engineering, bio risk, environment, level of health care, privacy and confidentiality and level of health care; these are detailed below.

3.1 Engineering: laboratory designing, refurbishment and construction should take into consideration the following engineering categories:

Item		Description
Engineering		<ul style="list-style-type: none"> This entails the general physical structure of the lab by the engineers.
Civil	Wall	<ul style="list-style-type: none"> Should be made of well baked clay bricks or Concrete blocks Should have a fire rating of at least one hour All walls should extend to the underside of the ceiling/floor slab above to maintain smoke and fire separation. Finishing should be smooth and painted with a washable paint for easy cleaning Beige or cream silk vinyl paint should be used for wall finishing. All penetration from pipes, ductwork, or wires should be sealed off. Clear and unobstructed emergency exit should be provided. Access corridors should be a minimum of 180 cm wide.
	Floor	<ul style="list-style-type: none"> Should be smooth for ease of cleaning. Finishing should be made of soft white/grey epoxy or Terrazzo. Seams/joints should be minimized to ease cleaning and minimize seepage of fluids Should be Slip resistant Should be impervious to liquids Should be resistant to strong chemicals and disinfectants. Any joints/cracks should be sealed with water and chemical resistant material. The edges of the skirting and the floor should be finished round.half
	Ceiling	<ul style="list-style-type: none"> Ceiling –wall joints should be curved without steps for ease of cleaning.

		<ul style="list-style-type: none"> • The ceiling should be smooth and continuous • The ceiling should exhibit high sound absorbance rating to minimize noise in the laboratory.
	Roofing	<ul style="list-style-type: none"> • The roof should be preferably made of steel structure. • The roofing sheets should be gauge 26. The colour/profile should match existing buildings.
		<ul style="list-style-type: none"> • Work tops should: <ul style="list-style-type: none"> ○ Be at least 80 cm wide (from the front wall) ○ Be 9-10cm above finished floor ○ Be smooth and easy to clean ○ Waterproof and resistant corrosion by acids, alkalis and other chemicals. ○ Resistant to vibrations and heat. ○ Fixed worktops should be made of reinforced concrete finished with epoxy or granite/marble ○ Edges of worktops should be rounded to ease cleaning. ○ Provide knee room for sitting tasks of (At least 91 cm clear width below windows ○ Provide for lockable shelving beneath the work tops at alternate positions with knee space. • Spaces between/beneath furniture should be easy to clean and decontaminate. • There should be room to enable future modifications. <p>Wall brackets and lockers: Shelves should be provided in the main working area. These should be 0.6M above the work top and 450mm wide. The lockers should be securely fixed onto the wall.</p> <p>Doors</p> <ul style="list-style-type: none"> • All internal doors should be solid core flush doors.

	<ul style="list-style-type: none">• External doors should be solid steel or glazed steel doors with burglar proofing. All doors should be painted with super gloss paint.• Two exits should be provided. One for routine (main entrance) use and one as an emergency exit. Doors should be within 23 M of furthest point of the laboratory for big laboratories.• Laboratory emergency exit doors should be swinging out and only openable from inside.• Doors should NOT be sliding type <p>Material used should have a fire rating of at least 1 hour</p> <p>Fire safety features</p> <ul style="list-style-type: none">• Most of the fires in clinical laboratories are classified as class C (Low fire Hazard) laboratories. They should have the following fire safety features:• Wall with a fire rating of one hour• Walls extending to the underside of ceiling/floor slab above to maintain smoke and fire separation between rooms. <p>Fire Safety</p> <ul style="list-style-type: none">• A fire alarm system should be installed in the laboratory at the reception or waiting area.• An easy and unobstructed fire egress should be provided.• Corridor for egress should not have items that feed fire (e.g. paper storage, waste items, electrical equipment, lockers).• Egress corridors should be a minimum of 180 cm wide.• Two or more exits, with the furthest point in the lab being no more than 23 m from an exit.• Egress should be away from areas of high fire hazard e.g. fume hoods, gas cylinders, flammable storage cabinets.• Install smoke detectors on the ceiling in the testing areas,
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		<ul style="list-style-type: none"> • Provide class C extinguisher within the vicinity of the exit door for all labs. Depending on the level of complexity of the lab, other classes should be provided. • Provide sand buckets and fire blankets to put out fires. • Paint for finishing should not be of flammable types like oil paint. • There should be an emergency fire assembly point. <p>Security</p> <ul style="list-style-type: none"> • Adequate lockable shelves,, lockable storeroom, for storage of major equipment, poisons and chemistry. • All windows, doors and vents must be protected with strong burglar proof. • All doors must be provided with secure locks. • Avail access control ensuring restricted access to the laboratory. • Ensure proper identification of all personnel within the laboratory.
Electoral	Power	<ul style="list-style-type: none"> • There should be a reliable primary source of power for all electrical equipment and lighting • Adequate number of sockets in vicinity of areas for equipment placement (to avoid use of extension cables) • Sockets should be located above the worktop and away from sinks and other wet places • Design should take into consideration specific power ratings of lab equipment recommended • Cabling should not interfere with movement • There should be provisions for additional sockets to cater for additional equipment/reorganization of floor plan. • Provision of 24-hour stand-by power backup source (solar power, inverters & accumulators) to maintain cold chain (blood, reagents, patient specimens). <p>Lighting</p> <ul style="list-style-type: none"> • Laboratory should be adequately lit (500 Lux of light are required)

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		<ul style="list-style-type: none"> • Ceiling lights should be mounted parallel to the work surface to provide uniform, shadow-free and glare-free illumination of the laboratory work top. • Typical ceiling mounted lights should be 61 x 122 cm or 61 x 61 cm fixtures with a parabolic lens placed in the ceiling grid 10 • Dimmers that allow users to adjust light intensity should be considered for microscopy areas • The lab should be well earthed with a resistance of not more than 5 ohms • Should have a well-grounded lightening arrester • Laboratories should have adequate natural lighting (large windows) <p>Data cabling</p> <ul style="list-style-type: none"> • Should not be embedded, instead should be on the surface (ducted / trunked). • Should be wide enough to enable additional expansion • Should be located above the bench
Mechanical	Water and Plumbing	<ul style="list-style-type: none"> • Reservoir tank should be installed to ensure uninterrupted flow of water • There should be no cross-connection between the laboratory water and the public water systems. An anti-backflow valve should be installed to protect the public water system • Each lab room should have a clean hand washing facility preferably near the exit door. • A ceramic/porcelain staining sink resistant to corrosion by strong acids and stain resistant should be provided • Laboratory sinks should be at least 41 cm wide x41 cm long x 20 cm deep Wash up sinks should be atleast 50 cm long x 41 cm wide by 30-40 cm. • An eye wash station should be provided. It should be 84 -114 cm above the floor and at least 15cm from the wall or obstruction on either side • Emergency showers must be provided for biosafety level 3 facilities, while drench hoses should be provided for Biosafety level 2 facilities. They should be 208 – 244 cm above the floor and no more than 30.5m from hazardous area. Floor traps should be provided in these areas. These facilities should be located not more than 10 seconds

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		<p>from the hazardous area. Flash sluice sink should be provided in the wash up from HC IV and above.</p> <ul style="list-style-type: none"> • Taps should be elbow operated or pedal or motion sensors (Hands free) • Drainages from laboratory sinks and basins should be closed and connected to a septic tank or closed deep pit as it may contain body fluids/biohazardous materials. • Water source and drainage system for water distiller should be provided from HC IV and above.
	Waste Management	<ul style="list-style-type: none"> • Waste generated from micro biology lab should be autoclaved and temporarily stored within/close to the washup room) • A temporary holding area near the lab space should be provided and cordoned off for general waste
	Ventilation	<ul style="list-style-type: none"> • Windows should; <ul style="list-style-type: none"> ○ Enable adequate lighting ○ Allow cross-ventilation with 6 – 10 air changes per hour ○ Ventilation on external doors and window tops in the glass glazing and not steel plates. ○ Not be in direction of prevailing winds to avoid disturbance of equipment like scales and generation of aerosols ○ Should have mesh screens to keep insects out <p>Should cover an area 15 – 20% of the floor area.</p>
Bio safety biosecurity		
Level of health care		<ul style="list-style-type: none"> • HCIII, HCIV, General hospitals and regional hospitals shall all have laboratories in line with the level of health care.
Privacy and confidentiality		<ul style="list-style-type: none"> • Provision of lockable pigeon halls for laboratory results
Patient flow		<ul style="list-style-type: none"> • To be determined after drawings
	Personnel welfare	<ul style="list-style-type: none"> • There should be a time out room adjacent to the laboratory to work as office and staff room • There should be a provision for hanging lab coats in the laboratory close to the exit

		<ul style="list-style-type: none">• There should be provisions for a clean area outside the laboratory testing area for personnel to keep their personal belongings.
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4.0 Level specific considerations

4.1 Health Centre III Laboratory

The Health Center III is the lowest health facility level where a formal laboratory services is offered, the laboratory facility at this level has the basic facilities for laboratory diagnosis, a basic biosafety requirements as detailed below:

4.1.1. Basic Services

Laboratory at health center III perform the following basic tests using the outlined technologies below: routine tests: Haemoglobin estimation, White Blood Cell count, Sickle cell screening, ESR, ABO/Rh grouping; Sputum for AFB, Gram staining, Wet prep; Blood slides for haemoparasites, Urine chemistry and microscopy, basic serology (HIV, Hepatitis B and C, Urine HCG, Syphilis, TB LAM, Cryptococcal antigen), Random Blood sugar, EID POC, CD4, CD8 count and ratios, stool analysis.

4.1.2. Biosafety level:

The laboratory shall be Biosafety Level II.

4.1.3 Number of personnel:

At least three (6) with two (5) conducting testing at any one time and one (1) support staff. Laboratory Technician (3); Laboratory Assistant (2); Support Staff (2)

4.1.4 Basic Equipment:

No	Equipment type	Number of equipment
1	Binocular microscope	3
2	Centrifuge	1
3	Refrigerator with freezing compartment	2
4	portable autoclave/pressure cooker	1
5	Bunsen burner and gas cylinder	1
6	Fire extinguisher	3
7	Haemocytometer	1
8	Kerosene stove	1
9	HB Meter	1
10	Spirit lamp	1
11	POC equipment for HIV tests	1
12	Glucometer	1
13	Blood grouping Tiles	1
14	ESR stand	1

4.1.5 Space requirements:

	Space type	Description	Approximate Area (M ²)
4.1.5.1	Waiting shade	Well aerated area with U-shaped concrete benches where patients sit to wait to be attended to.	16
4.1.5.3	Phlebotomy room	Room with two chairs and a table (desk) where specimens are collected. It should be connected to the main laboratory by a window with sliding shutters. Should have	4.5

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		a wash hand basin/sink, 4.5 13 adequate lighting and storage space. (Drawer), Granite worktop finishing.	
4.1.5.4	Reception Room	Granite work tops, computer and lockable	4.5
4.1.5.5	Main Laboratory Room	<ul style="list-style-type: none"> • One room used for specimen processing, examination and storage • Should have adequate cross ventilating windows. • Should have a door leading to the store and another to the wash-up room • Should have shelves and lockable cupboards, firmly built in leveled worktops • Should have 8 power outlets; 2 above each of the 2 work top and 2 on each of the other 2 walls • Should have hand washing sink located close to the exit and a separate sink for testing procedures 	2.5
4.1.5.6	Wash-up room	<ul style="list-style-type: none"> • For cleaning laboratory ware and temporarily hold waste before disposal. • Shall have 3 large porcelain • sinks, flash sluice sink, a portable autoclave and water purification equipment. 	8
4.1.5.7	Store	<ul style="list-style-type: none"> • With L-shaped shelves (on two walls) for storage of reagents, supplies and equipment that are not being used. • Shelves should start 0.75m above the floor and 0,45m apart and extending to ceiling. • Shelves should be 60cm • Window should be 1.2 by 0.6m and should be at 1.5m above the floor and should be burglar proofed <p>Temperature control systems</p>	10
4.1.5.8	Power House	Room for standby power source such as invertors and accumulators	2.25
4.1.5.9	Office	<ul style="list-style-type: none"> • With office chair and table • Computer station • Filing cabinet Three office chairs 	8
4.1.5.10	Toilets	<ul style="list-style-type: none"> • Laboratory personnel shall share these facilities with other units of the health facility. Two toilets (Female and Male), fitted with sanitary requirements. 	3 each

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Tea Room	<ul style="list-style-type: none">• Tea room should have worktop and food storage component with gas cookers	6
	<ul style="list-style-type: none">•	

Fig: 1: SKETCH OF PROPOSED LABORATORY DESIGN FOR HEALTH CENTRE III LABORATORY

4.2 Health Centre IV laboratories:

4.2.1 Major activities:

Laboratory expected to perform basic microscopy, FBC, HB, Sickle cell, bleeding, clotting and prothrombin time, ESR, ABO grouping and compatibility tests, CD4 Percentage, AFB, stool and urine analysis, heamoparasites, Swabs, HIV, Syphylis, TB LAM, Brucella, Typhoid, Helicobacter pylori, Heptatis: A,B & C, cyrptococcal, Malaria, TB,LFTS, RFTS, Lipid profile, Electrolytes, pancreatic tests, CNS analysis serology by rapid/agglutination tests/agglutination tests as well as blood banking and POC

4.2.2 Biosafety level:

The laboratory shall be biosafety level II

4.2.3 Number of personnel:

10 with 4conducting testing at any one time, 2 at reception, 2 at the phlebotomy and 2 in wash room. 2 Laboratory technologists; 4 laboratory technicians, 2 Laboratory assistants and 2 support staff.

4.2.4 Major equipment:

Specific Equipment	Number of Equipment
• Laboratory Refrigerators	6
• Blood Bank Refrigerators	1
• Water Bath	1
• Binocular Microscopes (100X, 40X, 10X, 4X)	1 Flourescent and 3 Electical Binoculars
• Hematology analyser	1
• Chemistry analyser	1
• CD4 analyzer	1
• Electrical Centrifuges (One for Blood Bank)	2
• Autoclave (in wash up)	1
• Fire safety equipment	3

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• Bunsen burner with gas cylinder	1
• Blood mixer	1
• Incubator	1
• Hot air oven	1
• Deep freezer -20°C	1
• Shaker	1
• Vortex	1
• Biosafety cabinet	1
• Hot plate	1
• Distiller	1
• Freezer	1
• Eyewash station	1
• Emergency shower station	1
• Flow cytometer	1
• POC for TB, HIV, HEPTATIS, HPV etc	

4.2.5 Space requirements:

	Space type	Description	Approximate Area (M²)
4.2.5.1.	Main working room	<ul style="list-style-type: none"> • Single room for specimen processing and examination • Should have adequate cross ventilating windows. • Should have a door leading to the store and another to the wash-up room • Should have shelves and lockable cupboards, firmly built in leveled worktops • Should have 8 power outlets; 2 above each of the 2 work top and 2 on each of the other 2 walls. • Storage facilities • Have a water purification system. 	30

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		Should have hand washing sink located close to the exit and a separate sink for testing procedures	
4.2.5.2	Wash up Room	For cleaning laboratory ware and disposal of waste Shall have a large sink, an autoclave At least two sinks, one dirty and one clean.	8
4.2.5.3	Office Space	<ul style="list-style-type: none"> • With office chair and table • Computer station • Filing cabinet Three office chairs 	8
4.2.5.4	Store	<ul style="list-style-type: none"> • With shelves for safe storage of reagents, consumables and equipment • Shelves starting about 0.75M above the floor, 0.45M apart and extending up to ceiling 	6
4.2.5.5	Blood Bank	<ul style="list-style-type: none"> • Room with refrigerator for blood storage. Must have a granite work top and at least two sinks. 	10
4.2.5.6	Phlebotomy room	<ul style="list-style-type: none"> • Room with two chairs and desk for phlebotomy Hatch window connecting to the main working area to pass on specimens and documentation A small window with sliding shutters connecting to waiting room. 	4.5
4.2.5.7	Reception	Room with seats and desk for receptionist 4.5 17 <ul style="list-style-type: none"> • Should accommodate cabinet for documentation • A window 90cm x 60cm connecting to phlebotomy room 	4.5
4.2.5.8	Waiting Area	<ul style="list-style-type: none"> • Benches on the verandah along exterior wall of the laboratory or an airy room with U-shaped concrete benches 	12
4.2.5.9	Toilets	Two toilets (Female and Male), fitted with sanitary requirements.	3 each
4.2.5.10	Power Room	<ul style="list-style-type: none"> • Small room for standby power source such as inverters and accumulators. 	3

4.2.5.11	Tea Room	<ul style="list-style-type: none"> • Tea room should have worktop and food storage component with gas cookers 	6
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4.3 General Hospital Laboratories:

4.3.1 Major activities:

Laboratory expected to perform basic microscopy, automated hematology, CD4 testing and chemistry as well as serology by rapid/agglutination tests, blood transfusion services and microbiological culture and sensitivity.

4.3.2 Biosafety level:

Laboratory shall conform to Biosafety level 2

4.3.3 Total number of personnel: These include (20 personnel)

- Principal technologist
- Senior technologist
- Laboratory technicians
- Laboratory assistant

4.3.4 Major equipment:

4.3.4 Minimum equipment requirements:

- 6 Laboratory Refrigerators 1 Blood Bank refrigerator 1 Water Bath
- 3 Binocular Microscopes (100X, 40X, 10X, 4X)
- 1 hematology analyzer
- 1 chemistry analyzer
- 1 CD4 analyzer
- 2 Electrical centrifuges (One for blood bank)
- 1 Autoclave (in wash up)
- Fire safety equipment
- 1 Water distiller (8 Litres per hour) Bunsen burner with gas cylinder Blood mixer

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- Incubator
- Hot air oven
- Deep freezer _20oC
- Shaker
- Vortex
- Biosafety cabinet Hot plate
- Gene expert

4.3.5. Space requirements:

	Space type	Description	Approximate Area (M²)
4.3.5.1.	Main working room	<ul style="list-style-type: none"> • Adequate room for specimen processing, examination and storage. • Air-conditioning system provided for proper functioning of the CD4, hematology and chemistry analyzers. • Should have a hand washing sink and sink for procedures. 	36
4.3.5.2	Microbiology Room	<ul style="list-style-type: none"> • Room for microscopy and isolation of risk group 2 pathogens. • To accommodate a biosafety cabinet, 2 laboratory refrigerators, 1 incubator, etc. • Should have a hand-washing sink and a staining sink. 	24
4.3.5.3	Media Preparation Room	<ul style="list-style-type: none"> • Clean environment for preparation of culture media 	4
4.3.5.4	Wash up Room	<ul style="list-style-type: none"> • For cleaning and decontamination of laboratory ware, autoclaving of culture media and treating, packaging and temporary storage of bio hazardous waste before disposal. • Shall have a sluice sink, and a clean sink for hand washing an autoclave and hot air oven. 	10

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		<ul style="list-style-type: none"> • It shall have racks on the wall for drying glass ware. 	
4.3.5.5	Store	<ul style="list-style-type: none"> • With shelves for safe storage of reagents, consumables and separate area for equipment. • Shelves starting about 0.75M above the floor, 0.45M apart and extending up to ceiling 	8
4.3.5.6		<ul style="list-style-type: none"> • Room with two chairs and desk for phlebotomy and documentation • A door connecting to the patients waiting area for issuing results. • Must have proper lighting 	
4.3.5.7	Blood Bank	<ul style="list-style-type: none"> • To accommodate a refrigerator for blood storage and a worktop against one wall 	12
4.3.5.8	Phlebotomy room	<ul style="list-style-type: none"> • Room with two chairs and desk for phlebotomy and documentation • A door connecting to the patients waiting area for issuing results. • Must have proper lighting 	6
4.3.5.9	Reception	<ul style="list-style-type: none"> • Room with seats and desk for receptionist • Should accommodate cabinet for documentation • A window 90cm x 60cm connecting to phlebotomy room 	6
4.3.5.10	Management Office	<ul style="list-style-type: none"> • Space for laboratory manager with desk, computer and 3 seats. • Shall have cabinets for storage of management files. 	6
4.3.5.11	Data Room	<ul style="list-style-type: none"> • Space for computer and filing cabinets • Shall accommodate a 2 data persons 	12
4.3.5.12	Resource Centre	Resource centre, night duty room and staffroom.	18
4.3.5.12	Waiting Area	<ul style="list-style-type: none"> • Should have window openings 2m x 1.5m without fitting for maximum ventilation 	12

		<ul style="list-style-type: none"> • Concrete benches in the shed where patients wait to be attended to or for results. 	
4.3.5.13	Incinerator	<ul style="list-style-type: none"> • Laboratory shall share this facility with other units of the health facilities. 	
4.3.5.14	Showers and toilets for staff and clients	<ul style="list-style-type: none"> • Separate toilets for female, male and PWDs toilets 	
4.3.5.15	Power Room	<ul style="list-style-type: none"> • Room for inverters and accumulators for stand-by power 	3

Fig. 3. SKETCH OF THE PROPOSED LABORATORY DESIGN FOR GENERAL HOSPITAL LABORATORY

4.4. Regional Referral Hospital Laboratories:

4.4.1 Major Activities:

The laboratory is expected to perform all testing done at the General Hospital laboratory including basic microscopy, microbiological cultures, automated hematology, CD4 testing and chemistry as well as serology by rapid/agglutination tests and blood transfusion services. In addition, the laboratory should perform molecular diagnostics as well as process specimens for histology and cytology. The laboratory shall also coordinate external quality assurance activities within its area of service and shall distribute proficiency panels in the area as well as re-examine a portion of tested materials.

4.4.2 Biosafety level:

The laboratory shall conform to biosafety level 3

4.4.3 Number of personnel:

(Pathologist, Principal Technologist, Senior Technologist, Technologist, Lab Technicians, Lab Assistants, Secretary, Data Clerk and Cleaners and shared Driver) (30 staff in general)

4.4.4 Major equipment (categorized according to sections)

4.4.5.1 General equipment:

GUIDELINES FOR CONSTRUCTION OF HEALTHCARE LABORATORIES IN UGANDA.

- 6 Centrifuges
- 4 Water baths
- 2 Autoclaves (1 in wash up room and 1 as back-up)
- 2 hot air oven (in wash up room)
- 2 Bunsen burners
- 5 Reagent refrigerators (Hematology microbiology and Chemistry)
- 2 Freezers (Minus 800C and Minus 200C)
- 1 Distiller
- 1 Deionizer
- pH meter
- 4 Fire extinguisher (Fire blanket, Bucket with Sand and 2 CO2 Cylinders)
- 4 Balance (2 Precision Balance and 2 Ordinary Balance)
- 15 networked computers (1 in laboratory director Office, 1 in reception, 2 close to working benches [Microbiology and parasitology] excluding the monitors for the automated devices, 1 in lab manager, 1 in the histology laboratory, 1 in the blood bank, 1 general laboratory, 1 in molecular laboratory, 1 in the store, 3 in the data room, and 2 in staff room)
- 1 printer
- 1 Photocopier

4.4.5.2 Hematology:

- 2 Hematology analyzers
- 1 CD4 analyzer
- 1 Automated coagulation machine
- 1 Binocular Microscope for Haemo-parasites films
- 2 sets of ESR Rack and tubes
- 1 Automated shaker/mixer
- 2 Stop Clocks/Timers
- Electrophoresis machine
- 1 fume hood

4.4.5.3 Blood bank:

- 2 Refrigerators (1 for Reagents and 1 for Blood bank Refrigerator)
- Cold room
- 1 freezer

4.4.5.4 Chemistry:

- 2 Chemistry analyzers
- Immunochemistry analyzers
- 2 refrigerators
- 1 centrifuge
- 1 fume hood

4.4.5.5 Microbiology, Mycology and Parasitology:

- 2 Water Bath (in media preparation room and examination room)
- 2 incubators (CO₂ and non-CO₂) – Space for CO₂ tanks required
- 3 Microscopes (1 Inverted, 1 Phased contrast and 1 Ordinary)
- 1 centrifuge
- 1 Bunsen burner - Space for gas cylinders required
- 1 ELISA washer and reader
- 1 serology shaker
- 1 Biosafety cabinet (1.3M wide, located away from area of busy traffic)
- 1 Gene expert machine (at least Four Model)
- 1 LED microscope
- 1 fluorescent microscope
- Automated blood culture instrument
- 2 Refrigerators (1 for Specimen, Reagents, Storing media and storing Primary plates) or 1 with several compartments •
- 1 Hotplate
- 3 Electrical Furnace
- Rotary platter
- Disc Dispenser
- Media Dispenser

4.4.5.6 Histology/Cytology (From Tissue reception through to Tissue disposal):

- Disposable grinder (Grind and dispose to sewer)
- Tissue basket
- Staining Machine
- Hotplate
- Coplins Jars
- Automated cover slipper
- 1 Microtome

GUIDELINES FOR CONSTRUCTION OF HEALTHCARE LABORATORIES IN UGANDA.

- 1 Frozen section microtome
- 1 histokinette
- Embedding machine (At Embedding station)
- Racks for storage of paraffin blocks and
- Paraffin Jars
- Water baths
- Museum for tissue archiving
- Microscope
- Fume cabinet
- Specialized storage space for Methanol, Formalin and Ether treated specimen

4.4.5 Space Requirements

	Space type	Description	Approximate Area (M²)
4.4.5.1.	Main working room	An open space with four work tops for chemistry and heamatology (20 personnel at single time). Air-conditioning system provided for proper functioning of the machines.	40
4.4.5.2	Microbiology / Parasitology Room	Three rooms with similar layout but varying in size as indicated. For specimen processing, examination and storage.	28
4.4.5.3	Cytology/Histology preparation and examination room	Space to enable packaging of tissue for referral as well as processing and examination of cytological specimens	25
4.4.5.4	Cytology/Histology office space and Storage	Two rooms for storage and office space.	20
4.4.5.5	Molecular biology laboratory	Four rooms for molecular diagnostics	16
	Media preparation room	With work top for pouring media	6
4.4.5.6	Wash-up room	For cleaning laboratory ware and disposal of waste. Shall have a sink and a flash sluice sink, an autoclave, and a distiller.	10
4.4.5.7	Store	<ul style="list-style-type: none"> • With shelves for safe storage of reagents, consumables and equipment • Shelves starting about 	12

GUIDELINES FOR CONSTRUCTION OF HEALTHCARE LABORATORIES IN UGANDA.

		0.75M above the floor, 0.45M apart and extending up to ceiling	
4.4.5.8	Blood Bank	Room with refrigerator for blood storage and work top adjacent to one wall(Autonomous unit of its own housing different sections ie cold room office for incharge blood bank, cross match)	24
4.4.5.9	Pghlebotomy room	Room with 2 chair and a desk for phlebotomy Window connecting to the main working area to pass on specimens and documentation. Another sliding window connecting to the patients' waiting shed for issuing results.	4.5
4.4.5.10	Specimen reception room	<ul style="list-style-type: none"> • Room with seats and desk for receptionist • Should accommodate cabinet for documentation • A window 90cm x 60cm connecting to phlebotomy room 	8
4.4.5.11	Common room	To serve as tea room, resting room, meeting room, and library	20
4.4.5.12	Conference/Training Room	For hosting training events and conferences	24
4.4.5.13	Director's office, pathologist office and head	Space for laboratory manager with desk, computer and 3 seats. Shall have cabinets for storage of management files.	
4.4.5.14	Waiting area	A well aerated room / area with concrete benches that can seat up to 20 -30 people.	18
4.4.5.15	Data room	For storage of records files	8
4.4.5.16	Staff Showers and Toilets	Separate male, female and disabled showers and toilets	11
4.4.6.17	Client toilets	Separate male, female and PWD client toilets	11
4.4.7.18	Power room	Room for inverters and accumulators for standby power	3
4.4.8.19	Incinerator	Incineration of laboratory waste shall be at the general health facility incinerator	

GUIDELINES FOR CONSTRUCTION OF HEALTHCARE LABORATORIES IN UGANDA.



Fig 1: SKETCH OF PROPOSED LABORATORY DESIGN FOR HEALTH CENTRE III LABORATORY



Fig 2: SKETCH OF PROPOSED LABORATORY DESIGN FOR HEALTH CENTRE IV

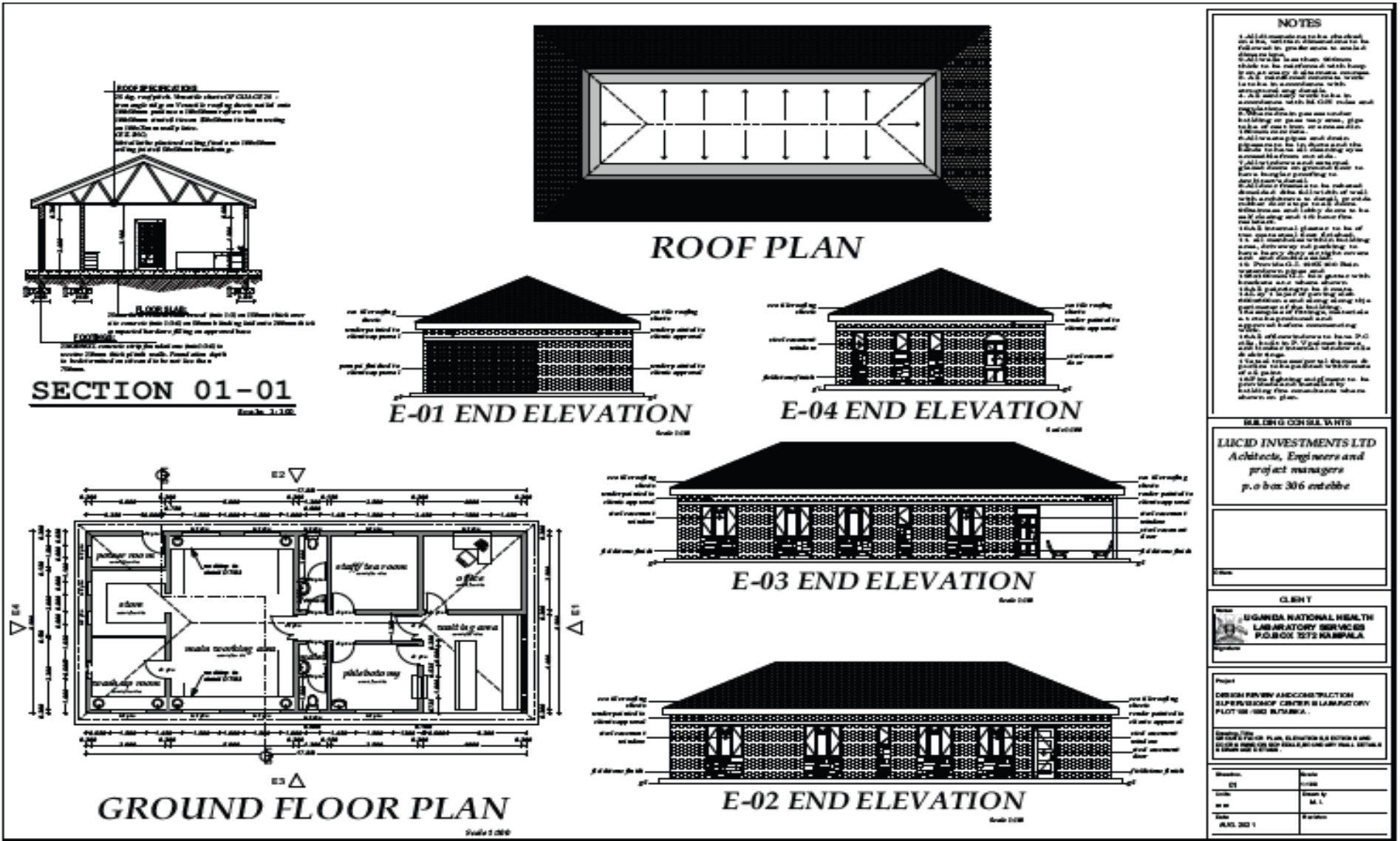


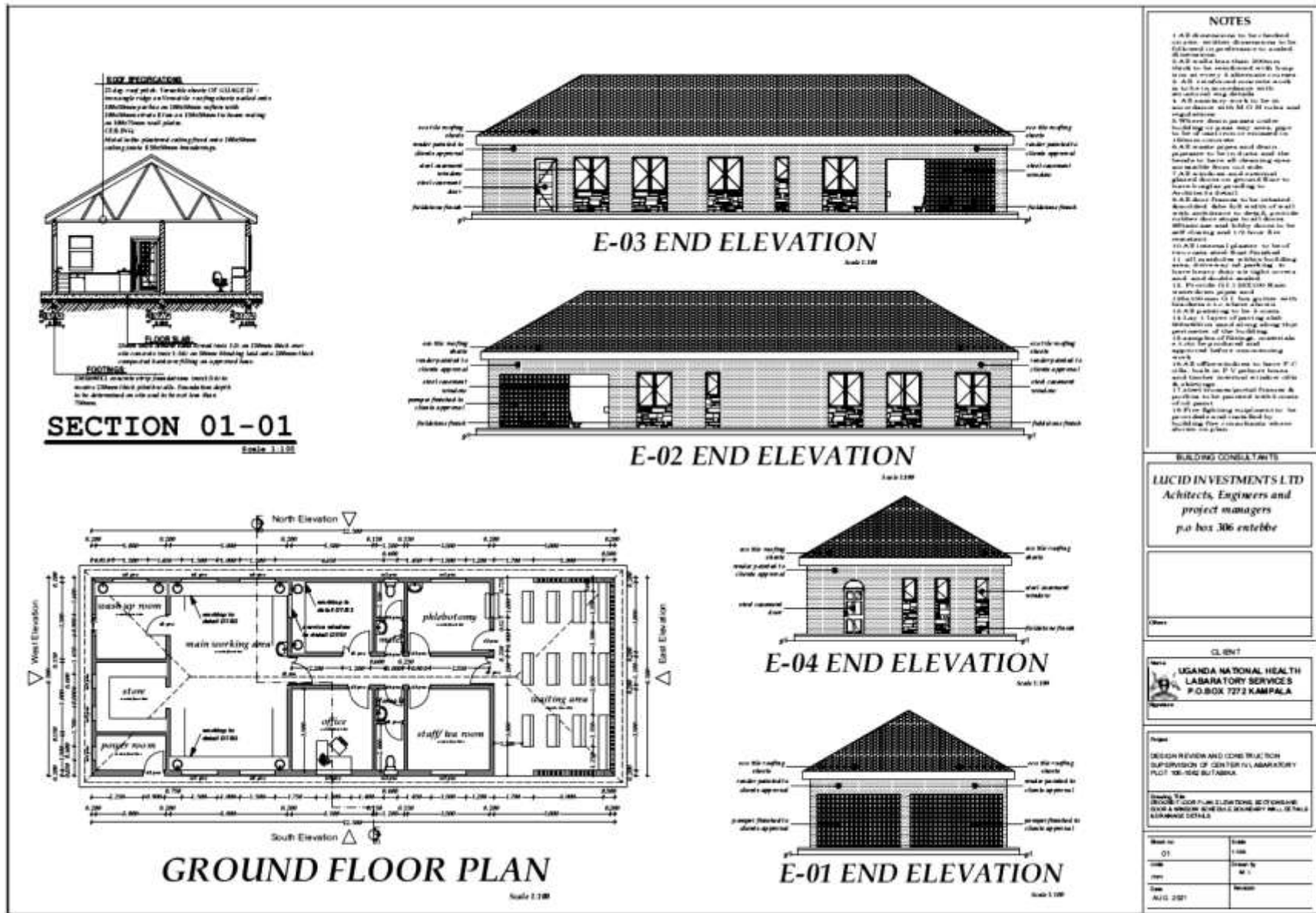


Fig: 1: SKETCH OF PROPOSED LABORATORY DESIGN FOR HEALTH CENTRE IV LABORATORY





Fig 2: SKETCH OF PROPOSED LABORATORY DESIGN FOR HEALTH CENTRE IV



GUIDELINES FOR CONSTRUCTION OF HEALTHCARE LABORATORIES IN UGANDA.



Fig: 3: SKETCH OF PROPOSED LABORATORY DESIGN FOR GENERAL LABORATORY



Fig 3: SKETCH OF PROPOSED LABORATORY DESIGN FOR GENERAL LABORATORY

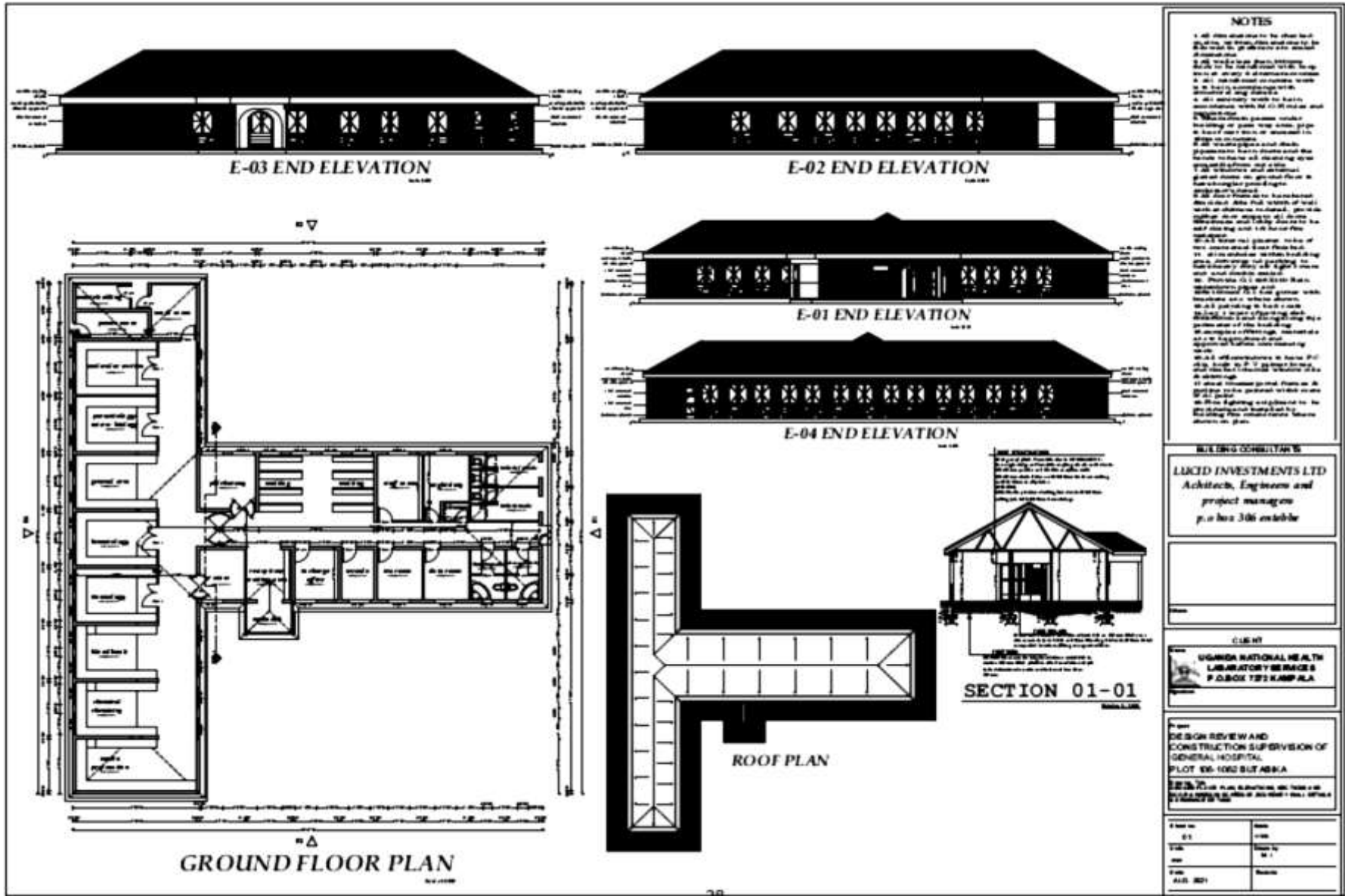






Fig. 4. LAY OUT OF THE PROPOSED LABORATORY DESIGN FOR REGIONAL HOSPITAL LABORATORY

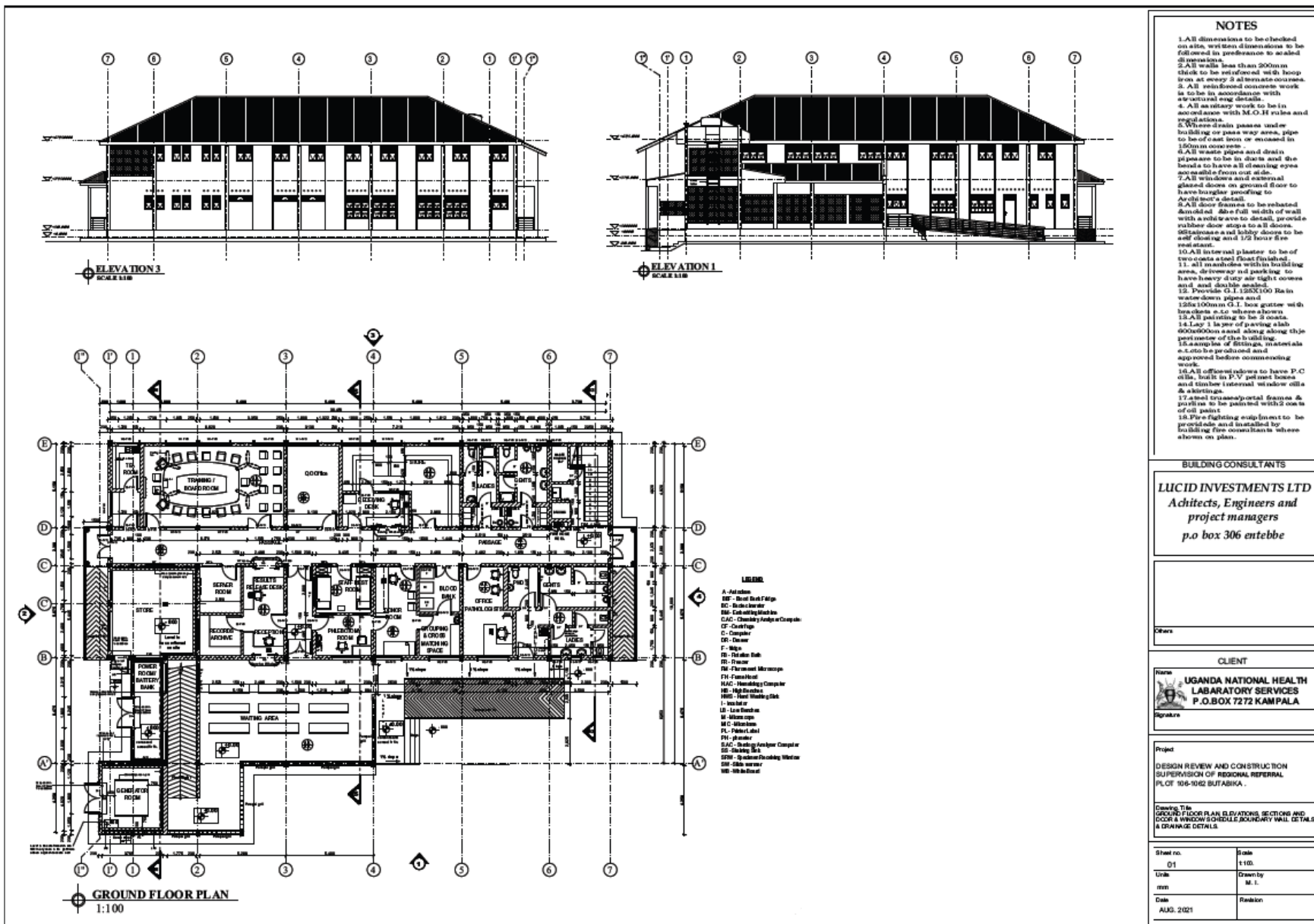
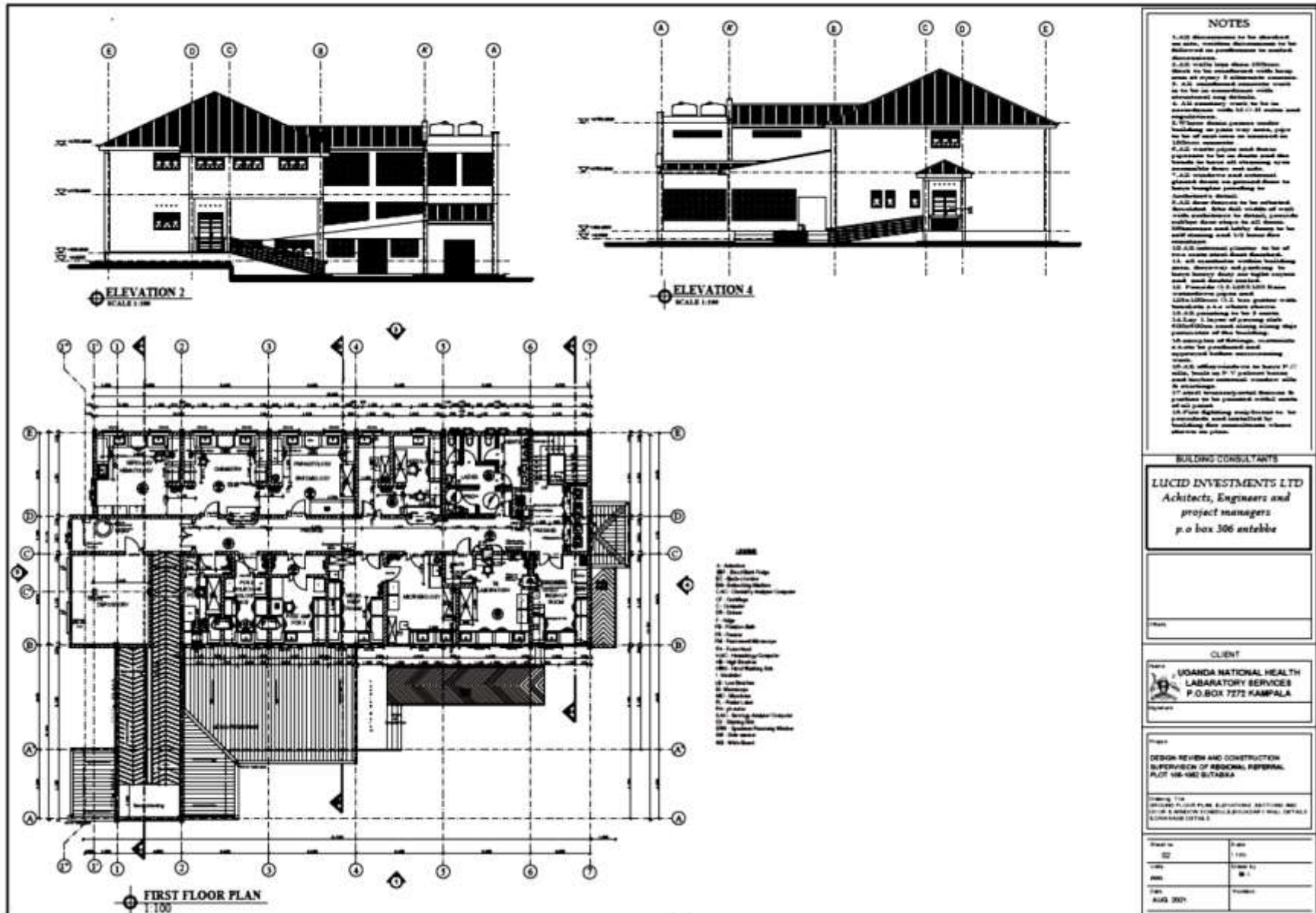


Fig. 4. LAY OUT OF THE PROPOSED LABORATORY DESIGN FOR REGIONAL HOSPITAL LABORATORY



ANNEX ; STEERING EXPERTS

- Ministry of Health (Dr. Olaro Charles-Director Clinical Services-MoH; Dr. Amone Jackson-Commissioner Clinical Services-MoH; Eng Nakiboneka Priscilla-Acting Commissioner Infrastructure-MoH).
- Uganda National Health Reference Laboratories-Ministry of Health (Dr. Nabadda Susan, Atek Kagirita Atwiine, Nkodyo Joseph, Diana Atwijuka, Eng. Mutaka Abdul-senior biomedical equipment specialists, Mujuzi Godfrey, Namanya Harriet, Eragu Rita).
- National Infrastructure Department-Ministry of Health (Eng. Mulepo Sitra; Eng. Lucky Kyomugisha)
- Laboratory Experts/ External Advisors (Mulindwa James-IDI; Ouma Peter Oballah-Baylor Uganda; Opio Joel-CDC Uganda; Aujo Deborah-Makerere University Public Health School; Mule William-Mukono DLFP)

