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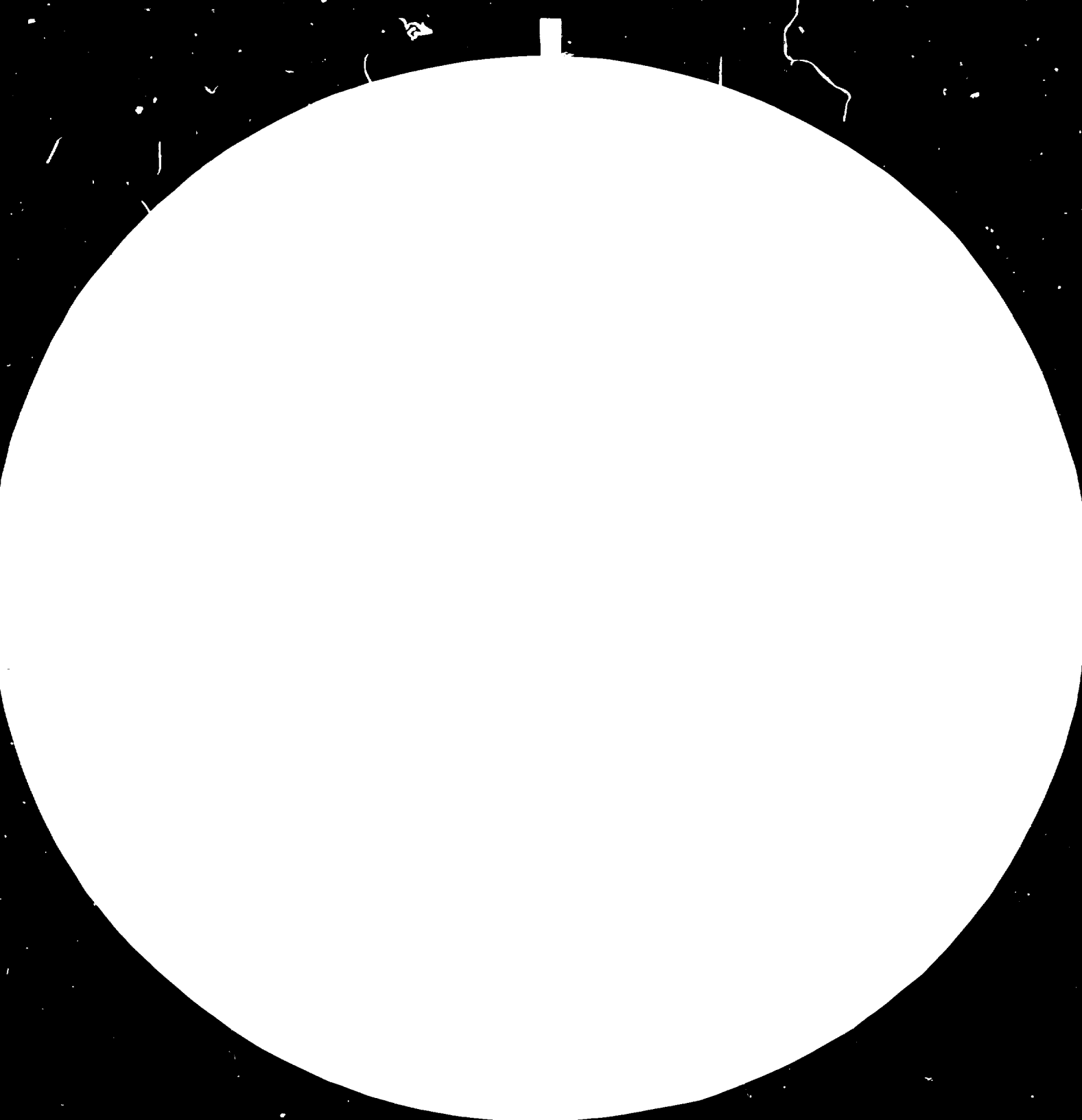

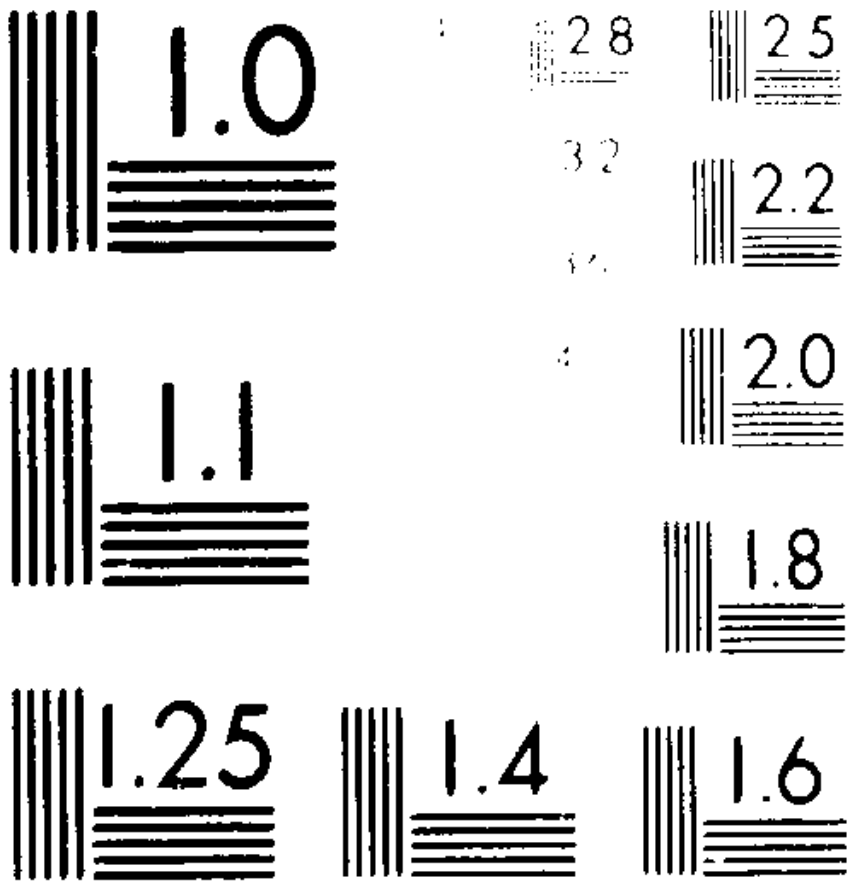
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UNIDO

(R) Report on a consultant mission

in metrication to

the Government of Seychelles,

13 April to 2 May 1980.

by

Dr S.A. Thulin
UNIDO consultant

Project Code No. SI/SEY/80/802/11-01/31.3.A

"This report has not been cleared by UNIDO and therefore only reflects the consultant's personal opinion"

ABSTRACT

This report summarizes the work of the consultant Dr S.A. Thulin in assisting the Department of Works, Ministry of Planning and Development in Seychelles during a mission from 13 April to 2 May 1980 (SI/SEY/80/802/11-01/31.3.A).

The work consisted mainly in

- drafting a law on Weights and Measures
- drafting suggestions for statuary regulations concerning measuring instruments to be applied in connection with the law
- making recommendations on national reference standards and verification equipment to be procured.

The draft suggestions for the law and the regulations were handled over to the government and are not included with the report, which however relates the considerations on which the suggestions are based.

A list of specifications of suitable metrology equipment is included in the report.

CONTENTS

I - INTRODUCTION

The mission of the consultant was to assist the Ministry of Planning and Development in their action towards the completion of metrication in the Seychelles.

The specific tasks of the consultant were in accordance with the job description (SI/SEY/80/802/11-01/31.3.A) to :

1. advise and participate in assessment of the present need for metric conversion in the country;
2. prepare drafts of the necessary legislation, rules and regulations;
3. assist in preparing metric conversion plan and implementation programme aimed at completing metric conversion by 1981;
4. make recommendations on secondary and working standards and maintaining them for calibration of weights and measures used in industry and commerce.

The request for the mission was based on the following facts included in the background information supplied to the consultant : The Seychelles Governement is planning to complete metrication by 1981. The weights and measures in the Seychelles are not only of indigenous origin, but due to historic reasons English weights and measures and measures with other country variations had all found a place in trade, commerce and industry in the country. In order to eliminate this confusion and to regulate domestic and foreign trade and also for other intrinsic advantages in the country, the Department of Works at the Ministry of Planning and Development has been nominated by the Government to implement the metric conversion in the country.

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The consultant was present in Seychelles from 13 April to 2 May 1980. During this short time he was requested by the Government to put main emphasis on the second and fourth points of the job description.

The first and third points had in fact already largely been taken care of by various working bodies of the Government either already long ago like in land surveying or more recently at the initiative of Mr Maxime Fayon, Principal Secretary (Works) of the Ministry who is in charge of the execution of the metrication programme and who was the consultant's direct government contact during the mission.

II - DRAFT WEIGHTS AND MEASURES BILL

The first task of the expert was to assist in the drafting of a metrication Act or Act on weights and measures for submission to the parliament and intended to replace the present act of 1880.

The consultant was lucky to find an abundant documentation collected by Mr Fayon mainly from English speaking countries. He was also fortunate to collaborate with a legal draftsman Mr David Jones who had already prepared a draft law based on information received from several Commonwealth countries.

The consultant advised that this draft should be modified so as

- to enlarge the scope of the Act to cover other activities of legal metrology involving human safety and safety of property

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- to include implicitely all SI units of measurement and some practical non-SI units but list in a specific schedule only those units which are used in common trade
- to leave out of the Act the wording of the scientific definitions of the basic units which may be subject from time to time to changes by the General Conference of Weights and Measures
- to include a simplified system for approval and control of measuring instruments intended to be imported or put into use in the country.

The Part II - "Standards of Weights"and Measures and Part III - "Inspection, verification and reverification" as well as the Schedules were rewritten by the consultant accordingly and put into legal language by Mr D. Jones.

This draft of Weights and Measures Bill was discussed and corrected at a meeting Mr Fayon, Mr Jones and the consultant on 28 April 1980.

As a conclusion of this meeting it is expected that the new draft after some minor typing corrections can be submitted to the Parliament of Seychelles.

III - WEIGHTS AND MEASURES REGULATIONS

The draft Act provides for a certain number of technical and administrative regulations concerning Weights and Measures to be issued by Ministerial decree (Statuary regulations).

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Such regulations contain in many countries a great number of technical details and may be quite voluminous. Within the very short time available the consultant tried to compile a simplified regulation which can be applied by weights and measures inspectors who have only limited training. It is in fact thought that in future legal control can at least in part be executed by inspectors concerned simultaneously with surveys on prices for consumer's protection taking into account the relatively limited number of measuring instruments available in the Seychelles.

It was in particular found necessary to simplify the regulations concerning weights and weighing instruments by reducing as much as possible the various accuracy classes of such instruments.

Weights

Thus only one accuracy class of weights for ordinary trade was included whether made of iron (down to 100 g only) or brass using tolerance limits corresponding on the mean to 0.05 % following approximately international practice for ordinary trade weights. Only one additional class of weights corresponding on the mean to 0.005 % and following roughly OIML class F2 weights has been considered to be used for weighing precious metals and pharmaceutical products.

Weighing instruments

In a similar way the types of beamscales have been reduced to include on one hand those having a pointer and scale or similar form of indication for use in weighing precious metals and pharmaceutical products with a mean accuracy of 0.005 % relative to the capacity

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and on the other hand beam scales encountered in ordinary market trade which have an accuracy of 0.05 % relative to the capacity.

Furthermore ordinary counter machines of the Roberval and Beranger pattern included in the regulation are considered to have minimum accuracies of about 0.1 % relative to their capacity whereas weighbridges, platform machines and similar constructions should have minimum accuracies of the order of 0.05 % or better.

Detailed lists of permissible errors for these various types of instruments have been included in the draft regulation which may also apply to more modern and sophisticated weighing instruments such as self-indicating and electronic balances in which case the maximum permissible error should according to international practice be marked on the instruments.

Analytical balances of other types than medium accuracy beam scales may be admitted for trade with precious metals and pharmaceutical products if they fullfil the accuracy requirements for medium accuracy beam scales and are of a construction which is approved for use in trade.

Spring balances are frequently used in various market trade. The consultant has however not tempted to include such instruments in the regulation : many types of construction are forbidden for commercial use in a number of countries and they may require special examination as to their zero setting devices to avoid fraud (usually only up to 4 % adjustment is allowed in some countries). On the other hand their accuracy is generally at best of the order of 1 $^{o}/_{oo}$ which may prevent them for use in certain types of trade.

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Such instruments are however comparatively inexpensive and the consultant considers that they may be admitted for use on a case to case basis to be decided by the Chief Inspector.

In all doubtful cases it is advised that the Chief Inspector in accordance with the provisions of the Act requires that any imported weighing instrument is accompanied by a certification that it can be used for trade. Such certification should generally be established by the legal metrology Service in the country of manufacture and follow the relevant recommendations of the International Organization of Legal Metrology (OIML).

Length Measures

The draft regulation specifies as regards length measures that these should be subdivided in no other units than metres, centimetres and millimetres. The use of double graduations in imperial and metric units should in fact be prohibited as otherwise by habit users will continue to measure with the part graduated in imperial (yard, foot or inch) units.

Though for reasons of simplification it is not stated in the regulation for length measures, the instruments to be used in trade shall normally correspond to OIML recommendation 35 class II for non-foldable rigid or flexible metal measures and to class III for measures, rigid or foldable, made of other materials.

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Measures of Liquid Capacity

There are so far no general international recommendations for capacity measures used in trade except for some types of laboratory glassware.

The drafted regulation has therefore mainly been based on permissible errors and other prescriptions prevailing in some English speaking or Commonwealth countries which require tolerance limits of the order of 1 % for measures of a capacity of 1 litre decreasing to 0.25 % for capacity of 20 litres in case of conical metal or glass measures and the double of these values for other shapes or materials.

Petrol pumps

The metrication of the existing petrol pumps in Seychelles has already been undertaken and is expected to be completed within a few months by the extension to kerosene deliveries in litres.

The regulation included in the draft is again identical to that in use in several English-speaking countries and thus includes the requirement for sight glass in the connection of the delivery hose as it is already practice in Seychelles (but not required internationally).

Generally it was found that for petrol pumps the wording of the Regulation of the Government of Botswana could be adapted with slight simplifications and by the important modification of increasing the limits of permissible error to 0.5 % in excess and in deficiency of the delivered quantity in accordance with international practice and OIML recommendations N° 5 and 28.

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Devices or instruments not included in the draft regulation

It was found that electrical energy meters though as regards units of measurement covered by the draft Act, do not need a particular regulation as their limits of accuracy and control are specified in a statuary ordinance concerning electricity supply (section 40 of Statuary Reprint Electricity Supply). The calibration of the physical reference standards (wattmeters and watthour-meters) used for the adjustment of the electrical energy meters in Seychelles may possibly require some form of official government statement. However, taking into account some prevailing practical legal international difficulties in this respect it may be too early to include any statement to that effect in any statuary ordinance.

As regards water meters it is possible to base a regulation on the OIML recommendation N° 49 which gives the specifications for cold water meters for domestic installation including their limits of permissible error. However, as a special ordinances are going to be issued concerning the water supply in Seychelles it may be preferable to include the regulation concerning water meters in this ordinance. A 100 litre (or more) transportable capacity standard for calibration of a water meter test bench may be provided within the general scheme of physical standards to be maintained in Seychelles in accordance with the Act.

Bulk (flow) meters for delivery of large quantities of hydrocarbon products (usually more than 500 litres) are usually subject to similar regulations and limits of error as far roadside petrol pumps.
A regulation text based for instance on the text in the Botswana regulation may be adopted.

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The verification of such meters usually requires the use of a suitable vehicle tank or fixed reservoir, which itself is calibrated (or gauged) on the basis of a standard capacity measure of 100 L (or more) or if it is sufficiently large and geometrically suitable from measurement of internal dimensions. It is advisable that before writing any regulation on such meters an agreement is reached with the hydrocarbon suppliers on the best method for Seychelles for official verification of the bulk meters used.

In any case the consultant does not advise the use of a master meter as reference instrument for calibration of bulk meters as such master meters usually have errors which are not much lower than common bulk meters use and in addition need to be certified at more or less regular intervals at some suitable institution abroad.

Bulk (flow) meters are used for fuelling of air craft in Seychelles. The consultant did during his stay not encounter any gauged vehicle tanks. Should such tanks be used and a regulation necessary it may again be based on the text of the Botswana regulation however again by deleting the possibility of using a master meter for the calibration (verification).

Stamping and sealing of measures and instruments

The drafted regulations do generally give some information as to the requirements for apposing a government verification stamp.

In many cases it is necessary that such stamps do not affect the functionning of the instrument and the consultant considers that it should where not otherwise mentioned be left to the Chief Inspector to decide where stamps and seals should be apposed in accordance with international practice.

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Die-stamps used for stamping are expensive and it is necessary to limit them to a few sizes like those presently in use by the Police. On the other hand if they are too small they may not be easily perceptiple. The use of identification marks (inspector's number) or even the year of verification may possibly be avoided as the inspectors may probably keep written records of the instruments containing sufficient means of identification.

The verification number year and other identification on large instruments can where necessary be applied in the form of a suitable label.

Items such as small weights and items which may be difficult to stamp such as length measures of steel etc or inexpensive length measures can be exempted from stamping and due to their low economical value simply seized if on any verification they are found not to be within the specified limits of error.

Conclusions as regards the regulations

The draft compiled by the consultant along the lines indicated above was after some further simplifications and, for legal purposes, the exclusion of particular references to International recommendations, found to be satisfactory. The final version will be typed in Seychelles, reviewed by the legal draftsman as regards wording and sent to the consultant for detailed checking.

IV - EXISTING VERIFICATION FACILITIES

The verification and stamping of weights, measures and weighing instruments is presently enthrusted to the Police which has as reference and working standards

- a box metric bronze weights in the range of 1 g to 5 kg
- liquid capacity measures of bronze, slicker-plate type to 2 litres
- a pack-away type beamscale for checking weights, capacity 7 lbs (3 kg)
- die-stamps of various sizes.

This equipment is kept in a wooden box in the central Police Station in Victoria. There are however no special workbench or balance bench facilities. About 100 to 150 items are stamped by the police every year. These items have generally to be braught to the Police headquarters. No facilities for adjustment of weights exist.

A base for verification of surveyor's tapes exists and was found quite suitable by the consultant. This base is 50 m long and has an intermediate point at 25 m. However some standard tapes will be required to verify the base from time to time, see below. Surveyor's tapes are presently checked yearly under the supervision of the Department of Works.

V - COMMONLY USED WEIGHING INSTRUMENTS

It was found that in market trade in Seychelles many items such as fish and vegetables are sold by the piece. One of the aims of the new laws will be to discourage this practice. Meat is frequently sold using spring balances.

The latter will as mentioned in the chapter regulations have to be examined individually as to their suitability (possibility of fraud) and accuracy. In other cases beamscales are used. Steel-yards are to be found on various places but mainly for weighing animals and bulk agricultural products. The new regulations will limit the use of steel yards to these applications and thus avoid their extension to retail trade.

A short survey was undertaken by the consultant concerning heavy weighing equipment and showed that the following balances were used in the main island Mahe :

Weighbridge	capacity	30 000 kg	at UCPS Company
"	"	20 000 kg	at Ciment Co
Crane spring balance	capacity	1 000 kg	at Cascade water treatment plant
"	"	250 kg	at slaughteries for weighing live animals in a special bin
Platform balances	capacity	500 kg	at Cascade Water treatment plant
"	"	500 kg	at Airport forweighing freight
"	"	250 kg	at Customs for weighing copra sacks
"	"	153 kg	at the airport for luggage check-in

A special hook balance with a capacity of 250 kg and 0,2 kg subdivisions was seen at the shaughteries. It is used for weighing dead animals and may due to its special construction and sensitivity have to be verified regularily. The balances at the slaughteries have dual graduation in kg and lbs which is not a good practice especially as the metric graduations on the hook balance are difficult to read.

It is likely that a number of other platform balances with capacities of 100 to 250 kg are being used in Seychelles and that consequently heavy working standard weights and means of transportation shall be provided for site verification of such balances.

VI - NATIONAL REFERENCE STANDARDS

As a result of the survey of the needs made by the consultant and with a view of implementing the new laws and regulations it will be necessary to provide already from the start for reference standards for weight, length and liquid capacity. These standards have to be accompanied by some means of comparison, mainly balances, so as to allow the comparison of working standards used by the inspectors to the national reference standards.

The consultant has in the lists below tried to simplify as much as possible the suggestions for standards and verification equipment so as to adapt it to the needs of the country.

The standards equipment shall preferably be permanently installed in a suitable clear office room in a similar way as the existing test installation for electricity meters. The required space is however more limited and about 15 to 20 m^2 seems sufficient. In this office a bench made from stone or concrete with a flat top surface shall be provided for the comparison balances. It shall be placed along one of the walls and have a width of 65 cm and length 350 cm (or more). The bench shall preferably not be exposed to direct sunlight. Suitable cupboards with 115 cm long displacable shelving shall be provided for the standards.

The responsability for the standards room shall be enthrusted to an engineer or a technician with training in physics or mechanics but who shall also have other technical duties so as to make best use of staff.

The equipment to be procured for the standards room is suggested as follows :

Primary Standards of mass

S 1 One primary series of mass standards each executed in one piece of non-magnetic stainless steel in accordance with OIML RI 20 class E_2, from 1 mg to 2 x 10 kg in denominations of 1, 1*, 2, 2*, 5, 10, 10* etc.

Separate boxes for the masses of 1 mg to 100 g, 100* g to 5 kg and for 2 x 10 kg

Boxes marked : (as required)

To be supplied with calibration certificate.

The 1 kg mass standard included in this set shall if legally required be calibrated by Bureau International des Poids et Mesures, 92 Sèvres, France. The calibrating institution shall also be asked to indicate the appearant mass for a density of 8 000 kg/m^3 as assumed for the weights and 1.2 kg kg/m^2 for ambient air.

Secondary Standards of mass

S 2 One series of masses for verification of analytical balances (and balances for drugs and jewelry) from 10 mg to 100 g in stainless steel conforming to OIML RI 20 class F_1

S 3 One series of masses according to OIML RI 20 class F_1 (or F_2), adjustable, made of non-magnetic material with corrosion resistant surfaces, heavy-duty transport cases suitable for mobile use.

Composition of the sets according to needs :

100 g to 2 x 2 kg (is used in conjunction with S 2)

or

10 mg to 2 x 2 kg (with masses less than 100 g executed as class F_1 not adjustable).

S 4 One set of verification masses, adjustable according to OIML RI 20 class F_1 (or F_2), made of non-magnetic material with corrosion resistant surfaces comprising a handle. Heavy-duty transport box. Set comprising 5 and 2 x 10 kg.

Calibration balances

S 5 Calibration balance

Capacity : 20 (or 25) kg

Repeatability s = 15 mg

- For the equal-armed type of construction one scale division should be equal or less than 50 mg and allow measurements by interpolation down to 10 mg. The equality of arms should be adjusted to better than $1 \cdot 10^{-5}$

S 6 Calibration balance

Capacity preferably : 2 kg (minimum 1 kg if not available)

(Total capacity with tare at least 2001 respectively 1001 g)

Repeatability s = 0.1 mg

- For one-pan constant load construction the interpolation micrometer should allow readings to 0.1 mg
- For the equal-armed type of construction one scale division should be equal or less than 1 mg and allow measurements by interpolation to 0.1 mg. The equality of arms should be adjusted to better than $1 \cdot 10^{-5}$

Length standards

S 7 One metric divided ruler length 1 metre preferably of corrosion resistant steel with millimetric graduation on lower edge to facilitate direct visual comparison to other rulers, rectangular (or quadratic) section.

Accuracy of the positions of the graduations on the mean ± 0.02 mm (at 20 °C), width of division lines 20 to 30 micrometers.

To be supplied with official certificate established by a national metrology service.

S 8 Three measuring tapes of stainless steel, total length 50 m divided in cm on the lower edge to facilitate comparisons with other tapes, to be used with a tension of 50 N, supplied with storage roll handles and certificates for every 10 cm established by a national metrology service.

(Two tension spring dynamometers, capacity 100 N should be procured for use with this item).

If required :

S 9 One set of calibration grade end length bars to British Standard BS 5317, consisting of 50, 100, 200, 500 and 1000 mm lengths. (These bars are used for calibration calipers or other tools used by the inspectors for verification of end measures).
The length bars shall be supplied with an official certificate from a national metrology service.

Capacity Standards

S 10 One set of flasks with graduated neck, generally according to OIML RI 43, adjusted at 20 °C in "delivered" capacity, set of 0.1 - 0.2 - 0.5 - 1 - 2 - 5 - 10 L. To be made from pyrex glass.

S 11 One standard volumetric measure in polished stainless steel, capacity 100 L, cylinder-conical body with castelled overfill neck and drain tap, mounted with rubber pads in a steel-tube tripod stand which fully protects the body. The stand shall have adjustable feet and be equipped with a spirit-level. Adjusted at 20 °C in "delivered" capacity (wetted walls) and supplied with certificate from a National Metrology Service.

VII - VERIFICATION EQUIPMENT

The verification equipment to be carried around by the inspectors will mainly consist of

IN 1 - IN 2 - IN 3 - Sets of weights in all essential parts identical to the specifications for items S 2, S 3 and S 4 above.

IN 4 One set comprising 25 (or preferably 30 in case of possible damage) weights of 20 kg for verification of heavy balances, parallepipedic shape, made from cast iron or cast steel, execution generally according to OIML recommendation N° 2 but equipped with removable seal screw for the adjustement cavity. Conveniently protected against corrosion by metal coating or epoxy paintaing.

IN 5 Flexible metal measures or tapes for verification of length measures used in trade, divided in mm, length 2 (and 5) m, generally to OIML recommendation N° 35 class II.

IN 6 Two (or three) sets of conical measuring flasks with graduated neck made from pyrex glass 0.1 - 0.2 - 0.25 - 0.5 - 1 and 2 litres adjusted in "delivered" capacity, generally to OIML recommendation N° 43. To be supplied in transport boxes.

IN 7 Two (or three) sets of glass pipettes range 1 to 100 mL in protective box. Standard laboratory quality grade A.

IN 8 Two sets of volumetric verification measures in stainless steel, cylindrical shape with neck and graduated sight glass or tube, capacities : 5 - 10 - 20 L.
The range of graduation should be at least $\pm$ 1 %.
(The typical use for the 5 and 20 litres measures of this item is the verification of petrol and kerosene distribution pumps).

IN 9 Calipers of good engineering grade of 200 mm length or more depending on needs.

It is for the moment not suggested to procure any transportable or pack-away type balance for the verification of weights. It is expected that most balances available where weights are being used will be enough sensitive to verify weights by substitution to working standard weights. When this is not the case or when precision weights have to be verified this shall be done at the standards laboratory using the balances referred to as items S 5 and S 6.

For the verification of prepacked commodities it is suggested to use any suitable self-indicating balance which is previously tested using the working standard weights (items IN 1 to IN 3).

The adjustement of weights which are out of the prescribed limits for permissible error and rejected by the inspectors will have to find a suitable solution by arrangement with a mechanical workshop (preferably under government control) which has drilling and lead melting facilities.

VIII - CONCLUSIONS

The consultant estimates that in spite of the short time put at his disposal he could with kind the assistance of his counterparts correctly appreciate the present situation and make his suggestions accordingly.

The law and the technical regulations that were drafted are not included in this report but were handled over directly to the Government for further action.

A list of suggestions concerning procurements of suitable national reference standards and verification equipment has been included in the report. It is based on the drafted law and regulations and on a brief local study of the necessities.


B-387