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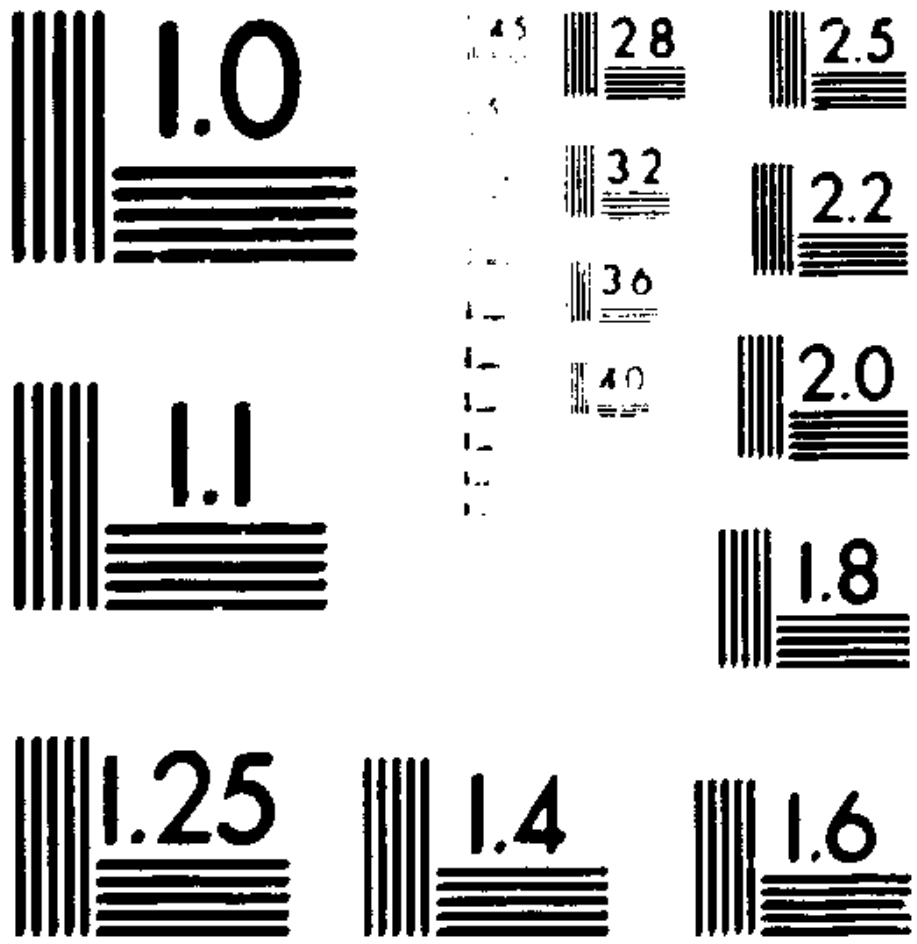

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STRENGTHENING OF THE COLLEGE OF LEATHER TECHNOLOGY, CALCUTTA

DP/IND/82/025

INDIA

Technical report: Recommendations on modernization plans, equipment and training programmes for the College of Leather Technology, Calcutta*

Prepared for the Government of India
by the United Nations Educational, Scientific and Cultural Organization,
associated agency of the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of P.G. Ellement, Training Specialist in Leather Science and Technology

United Nations Industrial Development Organization

Vienna

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EXPLANATORY NOTES

1. Value of local currency in terms of U.S. dollars:

   100 rupees = $11.46 ($1 = 8.725 Rupees)

2. The following abbreviations are used in this report:

UNIDO	United Nations Industrial Development Organisation
UNESCO	United Nations Educational Scientific and Cultural Organisation
ILTA	Indian Leather Technologists Association
CLRI	Central Leather Research Institute
BLMRA	British Leather Manufacturers Research Association
SATRA	Shoe and Allied Trades Research Association
LPA	Leather Producers Association
IULTCS	International Union of Leather Technologists and Chemists Societies
SLTC	Society of Leather Technologists and Chemists
ICT	International Council of Tanners
ILO	International Labour Organisation
TPI	Tropical Products Institute
FAO	Food and Agriculture Organisation
SDC	Society of Dyers and Colourists
OECD	Organisation for Economic Co-operation and Development
BASF	Badische Anilin Soda Fabriken
CTC	Centre Technique du Cuir

Mention of firm names and commercial products does not imply the endorsement of the United Nations.

ABSTRACT

This report, which has been prepared by a training specialist, presents information to be used on Project DP/IND/82/025 "Strengthening of the College of Leather Technology, Calcutta". The main objective of the Project is to re-establish the College of Leather Technology as a major Institute for the education and training of operators, technicians and technologists for the Indian Leather Industry. This is to be achieved by developing the existing College site as a central training unit with updated experimental tanning and process control facilities. A new site will provide facilities for Research and Development and shoe and leathergoods manufacture.

The information presented in this report covers the following topics:-

i) modernisation plans for laboratories, workshops and lecture rooms.

ii) selection of machinery, equipment, audio visual aids and other teaching facilities needed for the modernisation programme.

iii) curriculum for training operators, technicians and technologists for the leather producing industry.

Field work was carried out over a five week period 23 August 1984 to 25 September 1984.

The main recommendations of the report are:-

i) the immediate preparation of a management plan with job descriptions for all academic and technician staff,

ii) the immediate appointment of a Professor of Leather Technology,

iii) the concentration of resources on technician courses at certificate and diploma level,

iv) the immediate appointment of a tannery consultant and plant installation and maintenance consultant to ensure that the practical tannery facilities are brought into use and are maintained.

TABLE OF CONTENTS

Chapter | Page

INTRODUCTION

A. Background to the Project

The author, P G Ellement, was appointed as training specialist on the Project DP/IND/82/025 "Strengthening of the College of Leather Technology, Calcutta" to advise on teaching facilities and curriculum as per contract SC/219.188.4(UNESCO). Overall objectives for the Project apply and are as stated in the Project Documentation. Modifications to the original Project Document were proposed in October 1984 following a visit to the Project site by the UNIDO backstopping branch (APPENDIX IV No.18).

The Project is designed to provide the leather industry in India (and in the eastern region in particular) with trained manpower both at operator and technician levels as well as at higher technical levels.

The raison d'etre for the Project is that at present only two out of the thirteen institutes in India which offer training courses in leather technology are providing higher and advanced training at graduate level; only one institute is providing post-graduate training. It was suggested that the out-turn of graduate technologists from these two colleges was grossly inadequate to meet the demands of the fast developing and expanding leather industry in India.

It was considered necessary, therefore, to initiate training courses at post-graduate level in the eastern region which has a huge leather industry comprised of more than 300 tanneries and leather products manufacturing units producing 35 per cent of the total production in the country. Also, this leather industry needs guidance and advice on constant adjustments needed in leather manufacturing processes depending upon various environment factors to control and improve quality of leather. Therefore, capability for providing technical consultancy and testing services has to be created in the College of Leather Technology together with related research and development programmes to support further development of the leather industry in the eastern region.

The College of Leather Technology, Calcutta, which is the only institute of its kind in the eastern region, has to play a vital and effective role in both training and research. It is proposed to strengthen the College so that it becomes a leading institute to carry out the programme of training and research. For this purpose the State Government of West Bengal has recently sanctioned funds for construction of new buildings, modernisation of the laboratories and workshop facilities, and for augmenting the teaching staff of the College. Also, funds have been allocated for setting up new laboratories related to footwear technology, leather finishing and product design. These facilities will be completed in the first phase of the project. The advanced level training courses and consultancy and testing services unit are to be established in a separate building in the second phase of the project. The land for this building has already been earmarked in the new Salt Lake City which is close to the present College campus. The post-graduate technologists will not only meet the requirements of the industry but will also alleviate the acute shortage of teaching staff in the leather technology institutes in the country.

Modifications to the original Project document propose that the main thrust of the Project should be directed towards the needs of the industry and that the programme of visiting experts should be altered to reflect the special needs in the areas of practical leather technology and machinery installation and maintenance.

B. Responsibilities of the Training Specialist

The training specialist worked in co-operation with the National Project Director, Dr H Rao, Principal of the College of Leather Technology, Calcutta and was required to:-

i) advise and assist in preparing modernisation plans for the laboratories, workshops and lecture rooms required,

ii) assist and advise in the selection of suitable machinery, equipment, audio visual aids and other teaching material needed for the modernisation programme,

iii) to draw up a revised curriculum for training personnel for the leather industry at undergraduate (operator; technician), graduate (technican-technologist) and post graduate levels.

A considerable amount of equipment for the tannery and laboratories had been ordered before the training specialist began his assignment so he was not able to influence the choice of particular items of equipment.

C. Purpose of this Report

The purpose of this document is to provide information and ideas to assist in the re-establishment of the College of Leather Technology, Calcutta, as a major institute for training operators, technicians and technologists for the Indian leather industry.

The training specialist is willing at all times to give further advice and practical help to ensure the implementation and success of this Project.

D. General Observations on the Project by the Training Specialist

The training specialist spent five weeks in Calcutta during the period 23 August 1984 to 25 September 1984. Frequent visits were made to the College of Leather Technology and to local tanneries. In addition the training specialist had numerous discussions with local tanners and ex-students of the College. (APPENDICES I; II; III). As a result of these discussions and visits the training specialist feels he must make some general observations about the Project and thinks it important that these observations should be considered while this report is being read and implemented.

i) insufficient background study has been given to the real training needs of the local leather industry in Calcutta and in the eastern region. Many of the tanneries are small family concerns employing less than fifty people. What they are most in need of is well-trained operators and technicians who have an interest and a concern in getting the best out of the raw material available to them.

A survey would certainly show that graduate and post graduate training had a low priority in most tanners' minds though there would be a graduate need in the larger companies.

ii) there is too great an emphasis on theoretical studies and on graduates, postgraduates and research and not enough on technicians and practical leathermaking skills. It is also important that some technicians are provided with basic training skills so that they can develop effective

in-company training programmes for new employees and operators (APPENDIX IV, Nos. 14; 17)

iii) careful consideration should be given to the extent of provision of research facilities. Research facilities are costly to establish and maintain and it is important that these facilities do not make disproportionate demands on the funds available at the expense of the training provision. Effort should concentrate in the area of development work, industrial trouble-shooting and practical orientated consultancy work.

iv) the content of the syllabus is not the most important component of the curriculum of study. The majority of the syllabi of current courses in Indian Colleges of Leather Technology (APPENDIX IV Nos. 5 to 9) very adequately cover the subject matter required at technician and technologist level. However, the important thing is the depth and manner in which the subject matter is covered and the way it is integrated with practical work.

v) the College of Leather Technology is overstaffed. It is more important to reduce present staff numbers to allow new appointments to be made in the areas of leather technology, audio visual techniques and statistics and computing, than to augment the existing staff.

The training specialist was able to complete all his duties and considerable thanks are due to the National Project Director, local tanners, staff of the UN Agencies associated with this Project and staff of the Department of Technical Education, Government of W. Bengal.

Some difficulties were created by the non availability of architect's drawings of the College site and buildings and this added to the time required to produce proposals for the use of buildings and layout of machinery.

Students of the College are to be thanked for making drawings of the ground plans of most of the buildings and the layout of machinery in the tannery.

The plans which accompany this report are based on these student drawings.

RECOMMENDATIONS

1. It is essential for the success of this Project that the initial emphasis in terms of manpower and resources should be given to establishing the experimental tanning facilities in the College. Students will gain immediate benefit from a programme of practical leather production and machine skills training. To ensure the implementation of this recommendation the following action should be taken:-

   (i) the appointment of a Professor of Leather Technology who has recent industrial experience.

   (ii) the appointment of consultants with experience in the areas of practical leather manufacture (tannery consultant - 4 months) and plant installation and maintenance (tannery engineering consultant - 9 months) to get the tannery areas into working condition.

   (iii) the introduction of a regular production of leather which will provide students with experience of sorting, selection, handling, machine work, etc.

   Suggested production: pigmented leather from raw goat.

2. An atmosphere needs to be created in the College which is conducive to work and study by both staff and students. To achieve this, action is required in the following areas:-

   (i) the improvement of the appearance of the college site.

   (ii) the provision of amenities such as social areas, private study areas, changing rooms and toilets.

   (iii) the provision of improved lecture room facilities.

   (iv) the updating of equipment in the tannery and laboratory areas and their maintenance in clean, working order. For this purpose adequate services are required and a generator should be installed to ensure that teaching and leather making programmes are not disrupted by loss of power.

3. If staff are to play a full part in the development of the College and its future success they must know the role they are expected to fulfil and be trained to be effective teachers and technicians. This means that as well as having the necessary academic training they must have practical skills and be trained on how to impart their knowledge to others. The following action should be taken:-

   (i) the preparation of a management plan for the College which identifies key posts.

   (ii) the preparation of a personal development plan for each teacher and technician which highlights what retraining is necessary, including teacher training.

   (iv) the reduction of staff numbers to the level of one full time teaching staff member and one technician to six students. Allowance should be made for potential growth in student numbers and for staff absences due to retraining.

   (v) arrange training placements for updating in the following subject areas:-

      leather technology (including effluent treatment)
      testing and production control
      machinery maintenance
      histology and microbiology
      footwear technology
      footwear and leathergoods design

4. It is important that the College has a good library and is able to provide an efficient technical information service to staff, students and to local industry. The library should also act as the centre for the production and cataloguing of AVA materials. The following action should be taken:-

   (i) the appointment of an Information and Placement Professor

   (ii) the appointment of an AVA technician skilled in photography and the production of teaching aids.

5. Emphasis should be given to training courses for technicians at certificate and diploma levels. Restrict graduate course enrolment to 8 -10 students per year and post graduate enrolments to 2 students per year. All students should receive some instruction on training skills.

6. Research and development work should be restricted to work of a practical nature and be of immediate relevance to the needs of industry.

Responsibility for the implementation of the Recommendations will fall on the following groups of people:-

(i) Government

Recommendations 1 (i); 2(i) - (iv); 3(iii); 3(iv); 4(i); 4(iii); 5 plus an ongoing commitment to provide adequate funding for purchase of materials (hides, skins, chemicals, etc.)

(ii) College of Leather Technology

Recommendations 1(iii); 3(i) - (iii); 4; 5; plus a commitment to maintain standards and to involve and liaise with local industry.

(iii) International Agencies

Recommendations 1(ii); 2(iv); 3(v); plus support in the provision of technical books, journals and audio visual aids, both software and hardware.

The training specialist must re-iterate that the ultimate success of this Project depends upon the ability of all the parties involved to establish a working, productive experimental tannery. Without this facility all the dreams of providing worthwhile undergraduate, graduate and post-graduate training and ultimately relevant development and consultancy services for industry will come to nothing.

1. THE COLLEGE OF LEATHER TECHNOLOGY, CALCUTTA

A. Existing Buildings and Facilities

1. Physical situation

The physical position of the College is not conducive to good education. The immediate local area is run down and lacks reasonable amenities - adequate roads, transport and sanitation. Suitable accommodation for students in the area does not exist.

2. College campus

The College occupies a large site with an area of approximately 8000 sq. metres. Though little can be done about the position in which the College is situated there seems little justification for the poor state of the College campus. The condition of the site can be quickly remedied by simple housekeeping measures that include clearing the site of rubbish and broken machinery, cleaning out blocked water courses and maintaining the gardens.

There is a very large pond on the campus (1300m^2) which is in an apalling condition. This could be filled in and the area landscaped to provide an area for relaxation which would greatly enhance the quality of life in the College.

3. Buildings

The following permanent buildings are on the campus and their positions are shown on the site plan (Figure 1: Scale 1cm to 10ft). Drawings are based on dimensions supplied to the training specialist.

(i)	Chemical laboratory	335m^2
(ii)	Tannery	700m^2
(iii)	Two storey building	
	finishing section	250m^2
	lecture rooms/library	250m^2
(iv)	Four storey building	1400m^2
(v)	Multi-purpose building (1)	
	shoe department	205m^2
	physics department	90m^2
	stores	105m^2

(vi)	Multi-purpose building (2)	
	taxidermy	$40m^2$
	microscopy	$45m^2$
	lecture hall	$100m^2$
(vii)	Bacteriology	$75m^2$
(viii)	Workshop	$75m^2$
(ix)	Other buildings (7) incl. shed, accommodation, common room, garage, boiler house, latrines	$330m^2$
Approximate total floor area		$4000m^2$

The following sub-sections deal with the general condition of the main buildings and areas referred to in (3) above.

4. Chemical laboratory

The facilities are quite unsuitable for their present use. Fume cupboards and work benches are inadequate and there is insufficient space for movement around benches. However, the building is in reasonable condition and could be converted to other uses - private study rooms, experimental dyeing laboratory and changing rooms. All general laboratories should be transferred to the new four storey building.

5. Main tannery

The tannery area is in a poor state, but is capable of being worked up to provide good experimental tannery facilities.

At the moment too great an area is being given to soaking, liming and tanning pits. At the same time there are insufficient numbers of small drums and paddles.

Most of the equipment is obsolete and should be disposed of. This area should be developed solely as a wet area (beamhouse, tanning, retanning, dyeing and drying). Mechancial operations (staking, buffing, etc.) and finishing should be done on the ground floor of the two-storey building.

6. Finishing section

This section is full of obsolete machinery which should all be disposed of. The area should be developed to house conditioning facilities, mechanical operations and finishing.

7. Library

At present the library facilities are quite inadequate and provide virtually no service to students or staff. The library should be extensively re-developed and housed in the new four storey building. New staff should be appointed.

8. Lecture rooms

These rooms are in a poor condition. They need redecoration and new equipment.

9. Four storey building

At present only the ground floor is being used. The use of this building should be extensively developed to house all the laboratory facilities:-

(i) electrical engineering
(ii) chemistry - general
(iii) chemistry - analytical and control
(iv) physics - physical testing
(v) histology & microbiology
(vi) computing & statistics
(vii) darkroom

and the library, information centre and seminar room. The Principal's office and all administration should move to the first floor of the two storey block.

10. Shoe and leathergoods department

None of the equipment in this department has been used for many years. It should all be scrapped and the area developed as a unit operations laboratory for chemical engineering and as an engineering workshop giving immediate access to the main tannery.. The redevelopment of the shoe and leathergoods department should take place on the new Salt Lake City site.

11. Physics department

This area is unsuitable for its present use. The physics laboratory should be transferred to the new four storey building and the present building converted into an extension of the stores.

12. Stores

Equipment and chemicals are being stored under appalling conditions. The stores should be redeveloped to include the present physics area.

13. Taxidermy and microscopy

These areas are unsuitable for their present use. New facilities for microscopy, histology and microbiology should be provided in the new four storey building. The present rooms should be converted to staff rooms allowing staff direct access to main lecture hall.

14. Lecture hall

This room is at present in a very poor condition. It should be repaired and redecorated and refurbished with new equipment to convert it to the main lecture room on the campus.

15. Bacteriology

Laboratory facilities should be transferred to the new four storey block and this area converted to extend the existing student social facilities.

16. Workshop

This area should be cleared and converted into a by-products laboratory. The area is well away from the main buildings. Basci workshop facilities for carpentry, welding and tannery maintenance to be provided in the old shoe and leathergoods department.

B. Alterations and New Use of Buildings

Most of the buildings on the site of the College are in need of cleaning and redecoration. It is most important that cleaning and repainting is done in those areas where new equipment and machinery is to be installed.
The general appearance of the site could be improved by external painting.

The following sub-sections refer to specific alterations and proposed new use for buildings. Details are shown in Figures 2 - 8.

1. Chemical laboratory (see Figure 7)

This building has good access to the tannery and should be converted to provide the following accommodation:-

(i) changing rooms, showers and toilets

(ii) clean, quiet writing area for students using the tannery

(iii) small lecture room for giving instruction to students using the tannery

(iv) experimental tanning and dyeing laboratory

(v) staff room

The existing drawing room and laboratory facilities can be transferred to the new four storey building.

2. Main tannery (see Figure 8)

The following action is suggested to update the tannery facilities:-

(i) brick up one end of the building to enclose five lime-soak pits and convert to experimental effluent treatment area. Suitable drainage and pumps needed to transfer process liquors from soak, lime, bate and drum areas. Portable industrial mixers, stainless steel construction, needed to agitate and aerate liquors.

(ii) fill in seven soak-lime pits and use the created area for three 100 gallon covered paddles (soak, lime and bate) and a heated drum (preferably stainless steel which allows flexibility of use and easy cleaning). Six small pits and three large pits remain for soaking and liming.

(iii) fill in six vegetable tan pits and use the created space as an experimental sole leather area suitable for small scale (30cm x 30cm pieces) production. Provide static and rocker pits and a small heated drum.

(iv) remove and dispose of evaporators, steam engine and obsolete machinery. Instal new machinery, drums and paddles as layout in Figure 8. As far as possible all machinerey and drums should have individual motorised drive.

(v) instal improved water supply in the wet work areas.

(vi) instal small steam boiler in the drying area and provide steam poker for dissolving vegetable tannins and chemicals.

(vii) instal generator to provide alternative power source. The generator should be capable of maintaining power to tannery machines and operating air conditioning in the physical testing and storage areas and keeping all teaching areas well lit.

(viii) staff room should be equipped to keep machinery catalogues, products guide, process recipes and health and safety information.

(ix) the tannery should have the following equipment:-

pits (effluent treatment, soaking, liming and tanning)	various
fleshing machine	1
fleshing, unhairing and scudding beams	3
paddles (soaking, liming, bating and tanning)-100 galls.	5
drums - 2ft x 1ft	12
4ft x 2ft	6
6ft x 1ft	1
horses	various
splitting machine (for wet-blue & vegetable leathers)	1
samming machine	1
setting out machine	1
shaving machine	1
vacuum drier	1
paste, toggle and hang drier	1
flat table for rounding and experimental work	various
inclined tables (setting out)	2
scales - 2kg	2
10kg	2
200kg	1
small tanning pits (2-10 litres)	various
rotary shakers (variable speed) to take bottles 1-5 litres	3
pump for pumping liquors for effluent treatment	1

It is important that in addition to production scale equipment there should be an adequate supply of equipment for carrying out experiments on small hide and skin pieces. Considerable basic knowledge can be learnt from small-scale experiments.

3. Finishing section (see Figures 5(1) and 6(1)

(i) Create an area within the finishing section for mixing finishes and for colour matching.

(ii) Provide external dust extraction wherever possible to reduce dust in the air and to avoid internal fires.

(iii) If possible, construct an internal wall to separate the finish application facilities (spraying, padding, airing off and plating) from the dust creating machines.

(iv) Scrap all obsolete machinery. Instal new machinery as layout in Figure 6(i). As far as possible all machinery should have individual motorised drives.

(v) If possible, remove toilet facilities to increase working area. Ample toilet facilities are available on first floor, in the tannery extension (see B.1. above) and in the four storey building.

(vi) Staff room should be equipped to keep finishing catalogues, product literature, etc. and health and safety information.

(vii) If possible, small experimental machines should be provided for curtain coating and rotary spraying. In addition, a flat bed photoelectric measuring machine would be useful for experimental work and a planimeter for area measurement of wet blue leathers.

(viii) The finishing area should have the following equipment:-

conditioning area	1
staking - slocombe machine	1
hand	various
buffing - cylinder	2
buffing - wheels (overshot and slow)	2
tables - padding, hand-boarding	various
spray booth	1
airing-off cabinet	1
hydraulic press and embossing plates	1
glazing - reptiles, goat and buffalo calf	2
ironing machine	1
measuring machine - pinwheel	1
rolling machine	1

4. Library and information centre (see Figure 4(4)

An extensive discussion on the library and information centre is given in Chapter III. This includes suggestions for physical facilities, staffing, books, information retrieval and audio visual aids.

5. Lecture rooms (inc. seminar room)

It is most important that lecture rooms and seminar areas are decorated and equipped to a high standard. Provision for lecture-seminar rooms has been made in the following areas: (see Figures 1; 4(4); 5(2); 7)

tannery extension (old chemistry laboratory)	2
first floor (two storey building)	2
third floor (four storey building) - seminars	1
lecture hall	1

Rooms should be decorated in light colours, have adequate levels of lighting and windows should be equipped with blackout facilities. Each room should have a quality wall mounted blackboard and an angled white screen for overhead projection.

It is suggested that moveable tables (4ft x 2ft) and stackable chairs should be provided for writing in all lecture rooms. This allows maximum flexibility of arrangement. Tables can be arranged in formal rows, hollow squares or solid blocks according to preference and teaching situation. Also, individual tables can be provided in the seminar room when it is used as the examination room.

Special audio visual aids equipment is listed in Appendix VI.

6. Electrical engineering laboratory (see Figure 3(1)

Facilities and equipment in this room to be decided locally.

7. General chemistry laboratory (see Figure 3(1)

This is a general laboratory and should be provided with a preparation area. No specialist apparatus is needed. Experiments requiring fume cupboards can be carried out in the analytical laboratory. The preparation area should have a large sink and will also provide services for the analytical laboratory. One of the benches should be provided with a vacuum line and portable vacuum pump.

The laboratory is designed for 12 to 15 students. Top pan balances should be provided in the preparation area and analytical grade balances in the analytical laboratory.

Improved water and drainage to the laboratory area is required.

8. Analytical laboratory (see Figure 3(1)

This laboratory is designed for carrying out official methods of leather analysis and basic production control. It should be provided with fume cupboards for acid digestions (perchloric) and kjeldahl digestion. Fume cupboards should be acid resistant (stainless steel) and be exhausted externally.

In addition to basic analytical glassware, the laboratory should be provided with equipment for leather analysis. A list of special equipment is given in Appendix VII.

Additional extended facilities for staff and advanced students will be provided on the Salt Lake City site.

The laboratory is designed for 12-15 students.

Improved water and drainage to the laboratory area is required.

9. Physics laboratory (see Figure 3.2)

Facilities and equipment in this room to be decided locally to meet the requirements of the syllabus.

10. Physical testing laboratory (see Figure 3.2)

This laboratory is designed for carrying out the testing of leather. A controlled environment room (conditioning) is provided. In addition to basic equipment - balances, press and knives for cutting test samples, etc., specialist apparatus is required. A full list of this apparatus is given in Appendix VII. Additional extended facilities for staff and advanced students will be provided on the Salt Lake City site.

The laboratory is designed for ten students.

11. Histology and microbiology laboratory (see Figure 4.3)

This laboratory is designed for section cutting and staining of skin sections for fats, dyes, elastic tissues, cells, muscle, etc. and for simple microbiological work on identification of moulds and bacteria on skin and leather and in process liquors.

The laboratory is not designed for culturing bacteria and such experiments should only be undertaken with care.

The apparatus for this type of laboratory is standard and should be provided from local sources and to local requirements.

12. Microscopy laboratory (see Figure 4.3)

Facilities and equipment in this room to be decided locally to meet the requirements of the syllabus.

13. Dark room (see Figure 4.3)

This room requires standard dark room facilities which should be decided locally. In addition to producing photomicrographs from work done in the microscopy and histology and microbiology laboratories the dark room will be a major asset in providing audio visual aids.

The College should produce sets of slides to support lectures as well as making training videos and films. These aids will have to be made in the College as material is not available elsewhere.

14. Computer and statistics laboratory (see Figure 3.2)

No modern applied science course can be considered complete unless students have a basic understanding of the use of computers and can apply statistical techniques to experimental design and analysis.

The College will not have direct access to a main frame computer but should have the following equipment:-

microcomputers, disk drives and VDU	3
printers (for type and graphics)	2
software - spreadsheets , etc.	various

15. Technical drawing room (see Figure 4.3)

Facilities and equipment in this room to be decided locally to meet requirements of the syllabus.

16. Experimental tanning and dyeing laboratory (see Figure 7(ii))

This laboratory is an extension of the main tannery area and is designed to provide small scale facilities for tanning and dyeing. Such experiments can be done in simple shake machines designed to hold Dewar vessels (thermos flasks) which will maintain the temperature or in Wacker units which use glass drums on rollers in a temperature controlled cabinet. Even simpler rotary shakers can be designed to hold plastic jars and bottles. Such equipment allows multiple experiments to be done on small skin pieces at very low costs.

Small scale experiments can be used to illustrate basic leather making principles and at the same time used to make leather under unsuitable conditions to demonstrate faults in processing.

This laboratory can also be used as a tannery control laboratory,

17. Machinery maintenance and workshop (see Figure 2)

This area has a dual function:-

(i) teaching area for basic workshop skills (carpentry and metalwork)

(ii) maintenance workshop for the tannery.

In addition to basic metal and wood working tools (planes, saws, drills, etc.) the maintenance area should be equipped with machine tools. A list of equipment is given in Appendix VIII.

18. Chemical engineering laboratory (see Figure 2)

This laboratory is provided so that chemical engineering unit operations of interest to leather manufacture can be studied. Facilities for studying the following unit operations should be available (see Appendix VIII):-

Fluid flow	:	fluid statics fluid dynamics streamline & turbulent flow pumps; fans; valves
Heat transfer	:	conduction; radiation; convection heat exchangers chilling and freezing
Drying	:	removal of moisture drying rates driers (tunnel; fluidised bed; spray; vacuum)
Contact equilibrium separation	:	extraction distillation washing

Evaporation : single and multiple effect evaporator

Mechanical separations : filtration
sedimentation

Water, drainage and power facilities need to be supplied to this laboratory. Layout of the laboratory should be decided locally.

19. Stores (see Figure 2)

The existing stores should be expanded to include the present physics area. This will allow the following storage areas to be provided:-

(i) air-conditioned room for keeping hydroscopic powders and products likely to be damaged by heat
(ii) air-conditioned raw hide store
(iii) finished leather store
(iv) flammables and poisons store
(v) dry area for electrical equipment - motors, starters, etc.

The stores should be re-organised and items placed on a computer based inventory. This would be a good computer based project for final year students and could be done as part of the management course. It is essential for the smooth running of the College that the stores should be efficiently organised. It is suggested that the storekeeper should report directly to a senior member of the academic staff, e.g. the Professor of Leather Technology.

20. Staff rooms

It is important that all staff (teaching, technician and administration) should have their own work areas. Staff rooms have been provided in the following areas:-

main tannery	1
experimental tanning and dyeing laboratory	1
finishing section	1
large lecture theatre area	2
library	2
microscopy laboratory	1
histology and microbiology laboratory	1
computer room	1

physics laboratory	1
physical testing laboratory	1
chemistry laboratory	1
analytical chemistry laboratory	1

A total of 30 places are provided in these various areas. All the rooms should be provided with desks, filing cabinets and book shelves.

21. By-products laboratory (see Appendix VIII)

Facilities and equipment in this laboratory to be decided locally to meet the requirements of the syllabus. The laboratory should be developed in conjunction with the effluent treatment area. It is suggested that work is restricted to a study of skin by-products.

hair
soluble collagen, gelatin and glues
greases and fat
dried proteins (globular; hidepowder)
fertiliser; soil conditioners

The development of this area could be done by final year B.(Tech) students as part of their project work.

22. Effluent treatment (see Figure 8)

A simple pit treatment plant is possible at one end of the main tannery using five of the soak lime pits. It is suggested that a pit system is set up comprising:-

non-acid liquors (plus mixing and aeration)
acid and neutralisation pit (plus mixing)
settling pit

Facilities must be provided for collecting used liquors from drums, paddles and pits and transferring them to the effluent treatment area. It is suggested that the effluent treatment plant is set up as part of a final year project study. The analysis of treated liquors can be done as part of the analytical course.

II. SALT LAKE CITY EXTENSION

It has been assumed in this report that extra facilities will be provided in Salt Lake City within the next two years. This provision will extend and supplement that at the College of Technology, Calcutta. The training specialist considers it would not be sensible to develop extensive wet work laboratories on the new site and that all bulk tanning facilities should be concentrated on the College site in Canal Road South. Therefore it is anticipated that:-

(i) all tannery facilities plus basic sciences, production control and practical orientated consultancy will be provided and work undertaken on the existing Canal Road South site.

(ii) graduate and post graduate students studying on the Salt Lake City site will do their practical tannery work on the existing Canal Road South site.

(iii) shoe and leathergoods production will be carried out on the Salt Lake City site and a suitable production unit provided. Machinery for this facility has already been selected by the backstopping team in UNIDO, Vienna.

(iv) all design work (leather, shoes and leathergoods) will be done on the Salt Lake City site and suitable facilities provided. A show area for new leathers, shoes and leathergoods should be included in the design area.

(v) a theatre style lecture room for conferences, a seminar room, lecture rooms, tutorial rooms and staff rooms will be provided.

(vi) a post graduate project laboratory including small experimental drums for post tanning operations will be built and equipped to a high standard.

(vii) a colour physics and dyestuffs testing and evaluation laboratory will be built and equipped to a high standard.

(viii) quality control laboratories for chemical analysis and physical testing will be provided. These facilities must be of such a standard that the laboratory can be registered as a national testing centre.

Additional notes

1. The training specialist draws the attention of everyone associated with this Project to the fact that CLRI Madras have recently built an extension centre in the tanning district of Calcutta to provide development, analysis and consultancy facilities for the local industry. The CLRI centre is equipped with an experimental tanning and finishing unit and a testing laboratory.

   It is important in this very costly area of provision that there is not too much duplication of effort.

2. Outline building proposals showing rooms and laboratories needed in the new extension are illustrated on the following sheets.

   The building proposed is a four storey building, ground area 50ft x 75ft and external buildings for storage, maintenance and for inflammables.

3. Facilities such as dark room, microscopy, histology and microbiology, computing and chemical engineering will only be provided on the Canal Road South site.

Project Laboratory

This laboratory should be equipped with small stainless steel drums and rotary shake machines for tanning and dyeing and a small drying area. All other leather processing should be done on the Canal Road South site. The laboratory should have good drainage. The drum area should be enclosed within a small well to keep other areas of the laboratory dry.

A list of special equipment is given in Appendix VIII

Product Control laboratory

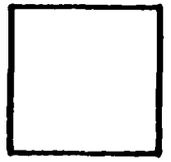
Colour physics and dyestuff testing

This laboratory in conjunction with the Project laboratory will provide extensive facilities for consulting and chemical testing. Although the laboratory will be able to carry out the analyses performed in the similar laboratory at the Canal Road South site it should also be equipped with modern analytical instruments. If a decision has to be made then basic classical analysis should be concentrated at Canal Road South and instrumental analysis at Salt Lake City.

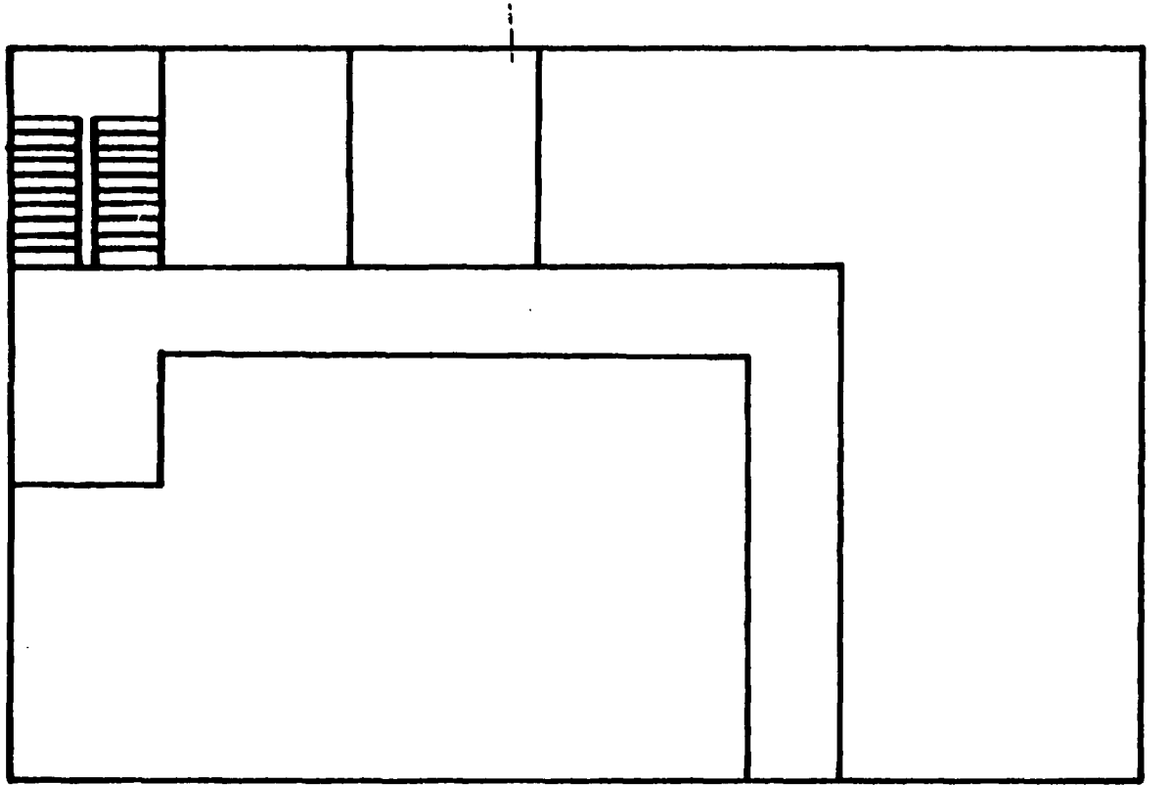
A list of special equipment is given in Appendix VII

Salt Lake City

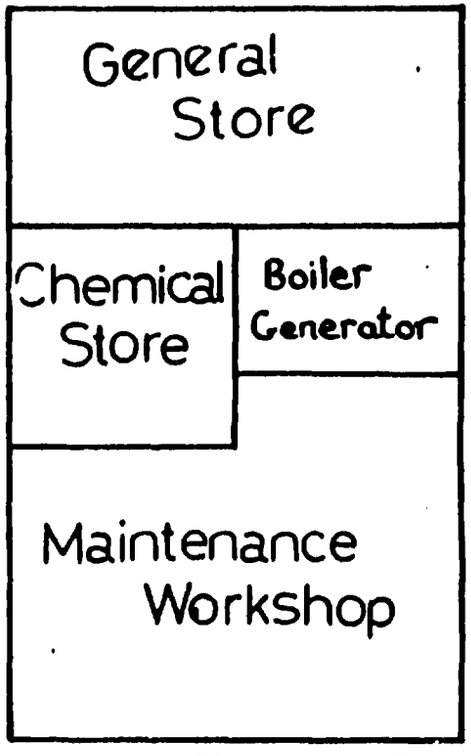
scale : 1cm ≡ 5ft



INFLAMMABLES STORE



FOUR STOREY BUILDING

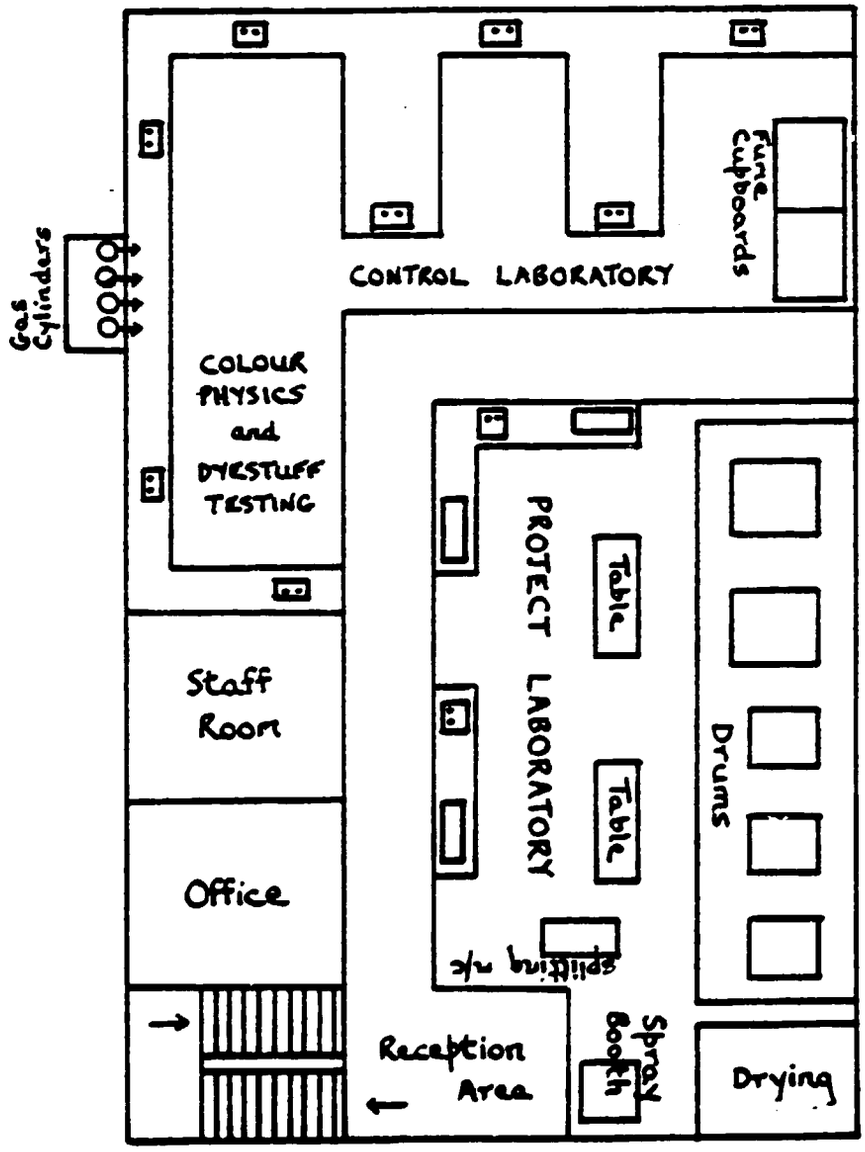


SINGLE STOREY BUILDING

Salt Lake City

Ground Floor Plan

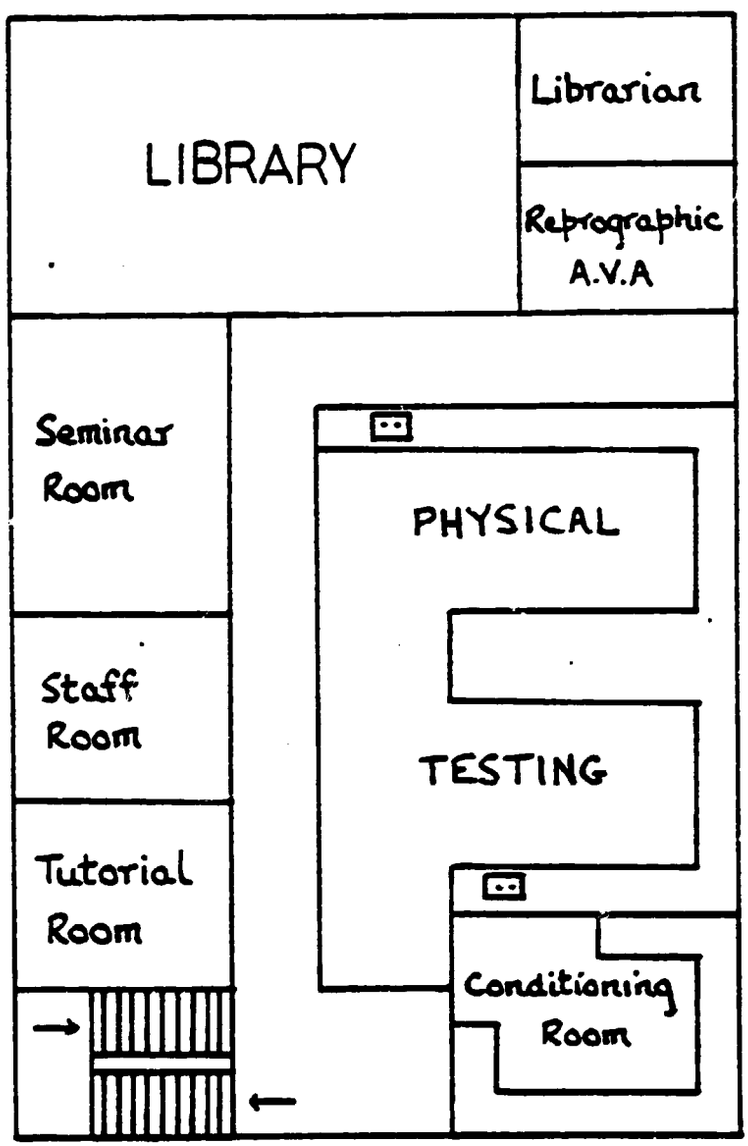
scale : 1cm = 5ft



Salt Lake City

Third Floor Plan

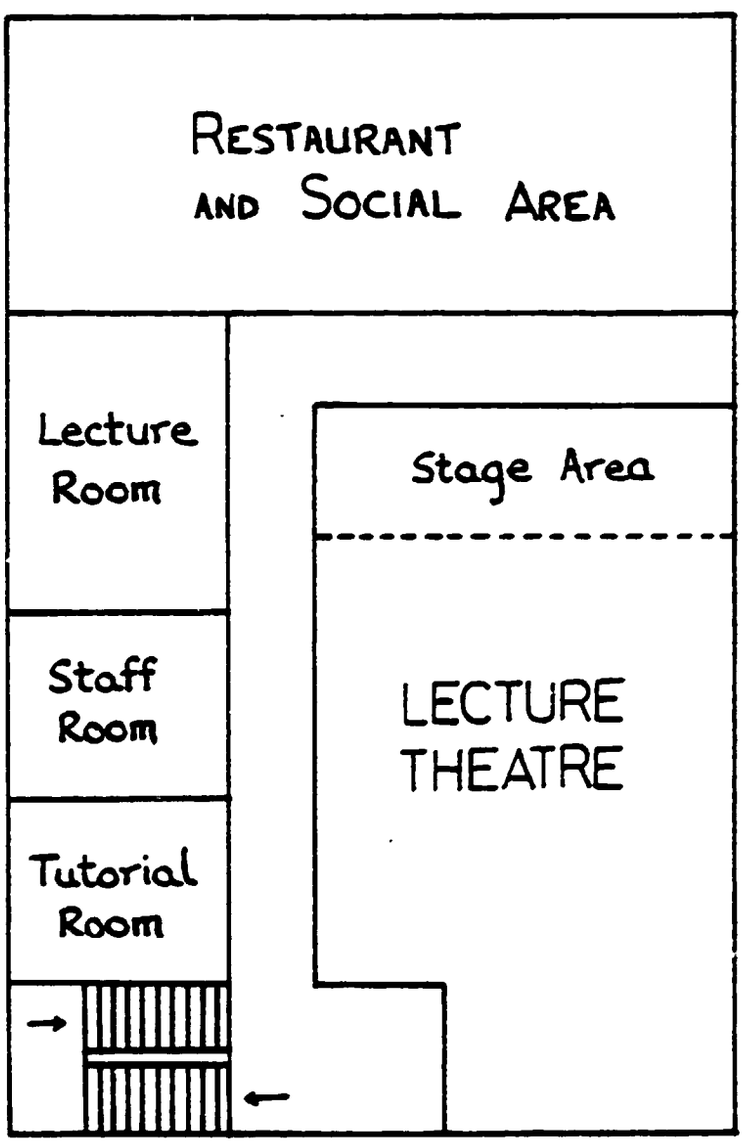
scale : 1cm ≡ 5ft



Salt Lake City

Second Floor Plan

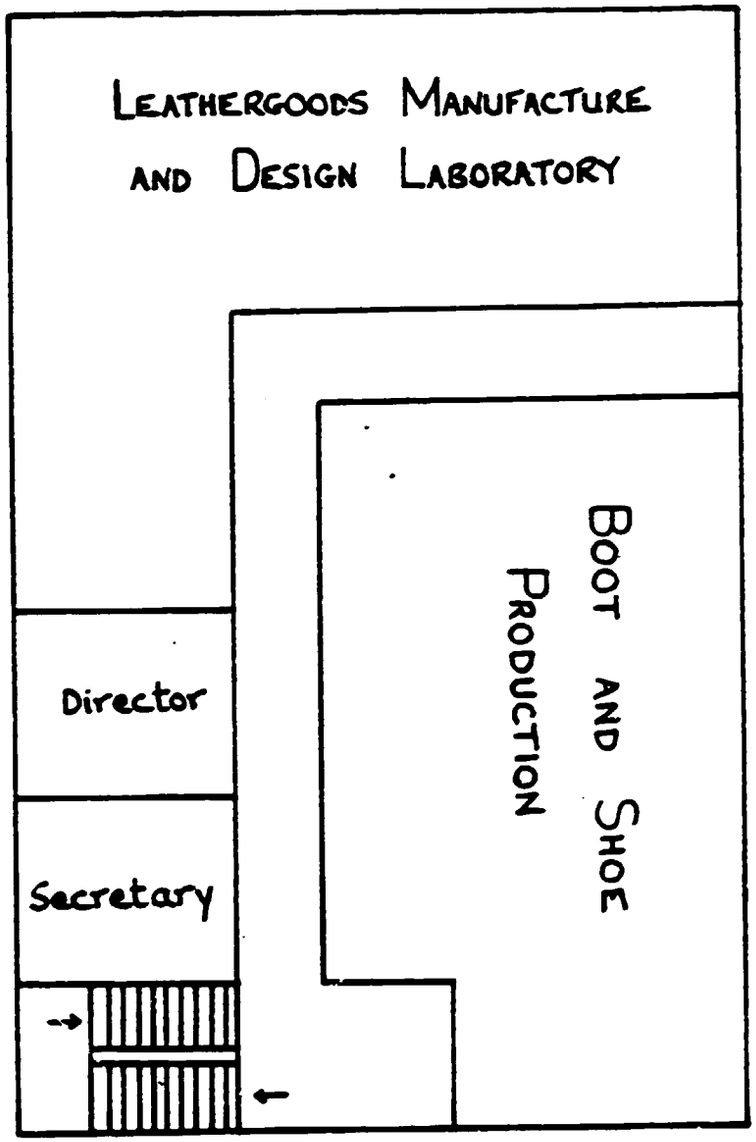
scale : 1cm ≡ 5ft



Salt Lake City

First Floor Plan

scale : 1cm ≡ 5ft



III. LIBRARY AND INFORMATION CENTRE

The library is an important part of any educational institute and regular use of the library facilities should be part of the course of study being followed by the student. As a course progresses students should expect to spend an increasing proportion of their study time in the library.

The organisation of a course should allow the student time for library study and the strategy of the course should demand a degree of self-teaching by the student which will require the use of library facilities.

Unfortunately, it is common for libraries to be under-funded so that they are unable to provide the facilities required by the staff and students. It is essential that the College of Leather Technology, Calcutta, has good library facilities and it is recommended that the library should be under the direct control of an academic member of staff, i.e., the Placement Professor. The Librarian would be responsible for the day to day operation of the library but would report to the Placement Professor who, in collaboration with other teaching staff, would decide library policy and plan future developments.

The library should be more than just a depository for books, journals and pamphlets ! It should provide an atmosphere for study and an information service for its users. The library could provide a much needed service for local industry and could be one means of encouraging local tanners to come into the College. It is essential for the success of the College that there should be a close working relationship between the College and the local leather industry. A source of up to date information on chemicals, machinery and current technical development, etc. could be of great value to the local industry !

A. Physical Facilities

Library area (see Figure 4)

The layout of furniture should allow for ease of movement and study comfort. Good level of lighting is required. Facilities are required for storing cases and hanging coats, etc.

Staff offices (see Figure 4)

Offices are provided for the Placement Professor and the Librarian. The office of the Placement Professor should have good interview facilities.

Furniture

Reading tables (4ft x 2ft)

Chairs

Journal racks

Bookshelves and cupboards

Filing cabinets

B. Staff

If the library is to provide a proper service and information is to be kept up to date then an adequate level of staffing must be provided. The following staff list is suggested as being appropriate:-

Librarian

Library assistant - catalogues and reprographics

Library assistant - AVA specialist

Secretary-typist

C. Books, Journals and Technical Literature

Books (see Appendix V)

The following broad categories of books should be provided. Titles of books on leather science and technology are given in the appendices. Other books should be selected according to local requirements.

General reference books : trade catalogues, dictionaries, encyclopaedias, atlases, etc.

General literature : classics, leisure reading

Leather science and technology

Other sciences and technologies : physics, chemistry, mathematics, computer science, statistics, civil, electrical, mechanical engineering chemical engineering, analytical chemistry, biology, technical drawing, health and safety, management, business and economics

Shoe and leathergoods

Journals (see Appendix V)

Very few books are published on leather science and technology. To keep up to date with current developments it is essential that the library subscribes to the major leather journals published in English.

Technical literature

Every company marketing chemical products and machinery provides technical information about their products. This technical literature is a major source of information for the leather industry.

It is important that the library has copies of the technical literature assocated with all the products and machinery used by students in the College of Leather Technology. In addition, there should be copies of instructions for the operation of all machines in the College as well as information on the construction, installation and maintenance of these machines.

Many of the larger multinational companies now produce books and pamphlets that deal with the principles of leather production.

The library should aim to have product information from all the major companies selling to the leather industry and they should be prepared to let local industry have access to this information.

D. Information Retrieval

A library may have large numbers of books, journals, pamphlets and other materials but this information source is useless unless the library user can get quick access to the information required. Therefore, it is essential that the library is well-organised and that there is a good cataloguing procedure.

As well as the traditional book catalogues under title, author or subject the library should aim to catalogue product literature and product use. A longer term aim should be to catalogue technical articles appearing in scientific journals. This can probably be most effectively done by making use of keywords. At present, worldwide, there is only a small input into cataloguing technical leather literature for information retrieval purposes.

The library should be provided with the following facilities for cataloguing and reprographics:-

Card index
Micro-fiche reader(s)
Micro computer(s)
Duplicator (spirit)
Photocopier

E. Audio Visual Aids (AVA) (see Appendix VI)

Software for audio visual aids (slides, film strips, films, video tapes, overhead projector transparencies, cassette tapes, computer programmes, etc.) should be catalogued and kept in the library.

Library and teaching staff should be involved in both the purchase and production of suitable AVA software for use in leather technology courses. A large amount of software is available for science courses (physics, chemistry, etc.) but almost nothing is available for leather science and technology and must be prepared by course tutors as required. Local catalogues should be consulted for AVA software for science courses.

IV RESEARCH, DEVELOPMENT AND CONSULTANCY

It is important that staff teaching at the B.Tech. level and above should be involved in some research and development work and in consultancy. This is necessary to enable staff to keep up to date and to provide their graduate and post-graduate students with a thorough grounding and understanding of modern theories, techniques and production methods.

In the situation in Calcutta it is suggested that there should be a concentration of effort in the areas of development work (improvement of processes) and consultancy (production control; trouble shooting, etc.). There is a need for first class practical experimental tanning and finishing facilities in the eastern region and the College of Technology could make a tremendous contribution to the development of the leather industry on both a local and national level by providing these facilities.

At a time when the leather industry in India desperately needs trained technicians and technologists with practical skills, the College of Technology, Calcutta, must resist the temptation to use scarce resources in building and equiping prestigious research laboratories. Resources should be put into establishing and extending the tannery, the boot and shoe department and the leathergoods department. The emphasis of the work of the College must be on improving the efficiency of production and on improving the quality of leather and leather products produced.

There already exists in India a huge research centre for the leather industry (CLRI, Madras) which also has a number of local extension centres. CLRI is more than capable of meeting the fundamental research needs of the Indian leather industry. It is then the role of State colleges and institutes to interpret this research to local industry and to provide facilities and expertise to demonstrate the new production techniques and materials which regularly become available to the leather industry.

In addition to CLRI, the State colleges and institutes of leather technology such as the College of Leather Technology, Calcutta, have access to research facilities and expertise in the Universities and Institutes of Technology. Contacts between universities and colleges should be encouraged. Such contacts not only broaden the outlook of staff but lead to a more cost effective use

of expensive research equipment.

Wherever possible joint consultancies and development work should be undertaken with local industry. This will ensure that the College maintains close contact with industry and is always aware of its changing needs.

Provision has been made on the Salt Lake City site for a project laboratory and improved facilites for production control. These laboratories,together with the tannery, on the Canal Road South site will provide the main facilities for the research and development work and consultancy. It is suggested that initially research and development work should be done in the following broad subject areas:-

(i) testing, analysis and evaluation of products used in leather production.

(ii) testing and analysis of leathers required to meet national and international specifications.

(iii) technical problem solving in relation to raw materials, production faults, user complaints, etc.

(iv) process and product improvement leading to cost reduction and better quality leathers.

(v) development of effluent treatment facilities for small tannery units.

(iv) utilisation of skin by-products (hair, gelatin, grease, powdered protein, etc.)

(vii) better utilisation of available hides and skins.

Further suggestions are made under the section dealing with student projects in the course syllabus.

V. COURSES IN LEATHER TECHNOLOGY

In 1976 Lakshminarayanan, Olivannan, Rao and Santappa (see Appendix IV) reviewed the need for high level technology for the Indian leather industry and projected that an additional one thousand trained leather technicians and technologists would be needed by 1979 if the planned expansion of the industry was to be realised and if leather of the desired quality was to be produced. Such a provision of trained staff was estimated to require an increase in the total capacity of the training colleges of about one hundred places a year. In addition, all the existing places in training colleges would need to be filled. It was suggested that the total number of students undergoing training would increase from the then 120 students to approximately 350 students a year.

Nearly ten years later virtually no new training capacity has been created and, in fact, the Diploma level course at the College of Leather Technology, Calcutta, is no longer running. A new four year B.Tech. course in Muzaffarpur, Bihar, is due to start in 1985 and it is hoped that the Diploma at the College of Leather Technology, Calcutta, will restart in 1985 or 1986.

Lakshminarayanan et al made the following recommendations:-

(i) rationalisation of existing diploma and certificate programmes; a common syllabus; upgrading of facilities.

(ii) a Central Advisory Board for education and training in leather subjects.

(iii) a common syllabus for B.Tech. in Leather Technology; exchange of staff between degree level colleges.

(iv) one year conversion course for graduate chemical engineers.

(v) B.Tech. students should be given an option to specialise in the final year in Management or Engineering or Industrial Chemistry Research.

(vi) economics of the leather industry should be included in the curriculum.

(vii) all students should do a six month industrial placement as a prerequisite to the award of a Diploma or B.Tech.

(viii) closer links with industry; the training institutes should be producing entrepreneurs not mere academicians !

It must be a matter of regret that these suggestions have not been more widely acted upon.

Of more concern is that statistics show that the leather industry has not developed economically in the way it was hoped it would. Although rawskin exports have been reduced dramatically a corresponding increase in added value in terms of leather and leather products has not been achieved. Repeated seminars and reports have pointed the way forward - "establish a firm infrastructure and base and develop technical education and training". Little has been done. There may be many reasons for this failure but the most important would seem to be:-

lack of expertise in finishing leathers suitable for the export markets
poor design
ineffective marketing.

A. Proposed Courses in Leather Technology at College of Leather Technology, Calcutta

It is suggested that the following courses should be provided at the College of Leather Technology, Calcutta and the Salt Lake City extension:-

Doctor of Philosophy (Ph.D.)

Organisation of course	:	practical plus tutorials
Type of examination	:	thesis and oral
Length of course	:	three years full time (48 weeks per year)
Number of students	:	one per year (maximum 4 in the College at any one time)
First enrolments	:	1988
Conditions	:	as determined from time to time by the University of Calcutta.

M.Tech. in Leather Technology

Organisation of course	:	lectures, tutorials, sessionals (practical)
Type of examination	:	written papers; practical & project; oral
Length of course	:	two years (32 weeks for 30 hours p.w)
Number of students	:	two or three per year (maximum six students in college at any one time)
First enrolments	:	1986
Entry qualifications	:	graduates with B.Tech. in Leather Technology
Conditions	:	as determined from time to time by the University of Calcutta

Postgraduate Diploma in Leather Technology

Organisation of course	:	lectures, tutorials, sessionals (practical) from the M.Tech. and B.Tech. in Leather Technology
Type of examination	:	written papers; practical & project; oral
Length of course	:	one year (32 weeks for 30 hours p.w) plus 18 weeks project work
Number of students	:	two per year
First enrolments	:	1986
Entry qualifications	:	graduates in Chemistry or Chemical Engineering
Conditions	:	as determined from time to time by the University of Calcutta

B.Tech. in Leather Technology

Organisation of course	:	lectures, tutorials, sessionals (practical)
Type of examination	:	written papers; practical & project; oral
Length of course	:	four years (32 weeks for 32 hours p.w)
Number of students	:	eight to ten per year
First enrolments	:	
Entry qualifications	:	pass in the two year Higher Secondary Certificate in Mathematics, Physics, Chemistry and Biology
Conditions	:	as determined from time to time by the University of Calcutta

Diploma in Leather Technology

Organisation of course	:	lectures, tutorials, sessionals (practical)
Type of examination	:	written papers; practicals & project; oral
Length of course	:	three years (32 weeks for 36 hours p.w)
Number of students	:	ten to twelve per year
First enrolments	:	1986
Entry qualifications	:	matriculation with minimum 50% pass in Science and Mathematics
Conditions	:	as determined by the College of Leather Technology, Calcutta

Certificate in Leather Technology

Organisation of course	:	lectures, tutorials, sessionals (practical)
Type of examination	:	written papers; practicals & project; oral
Length of course	:	one year (32 weeks for 36 hours p.w)
Number of students	:	twelve to fifteen per year
First enrolment	:	1986
Entry qualifications	:	matriculation with passes in Science and Mathematics
Conditions	:	as determined by the College of Leather Technology, Calcutta

B. Course Regulations

The following regulations for the proposed courses in Leather Technology should be devised locally so that they confirm with the regulations for similar awards in other disciplines:-

Conditions of admission
Duration of courses
Eligibility for an award
Attendance requirements
Examination requirements
Examination scheme and mark allocation

Course organisation - semesters

examination timetable

Classification of awards

C. Assessment

The training specialist suggests that the assessment and mark allocations should be altered to give greater emphasis to practical work and that practical examinations should be replaced by continuous assessment.

Certificates and Diplomas

General subjects (management, humanities)	:	Written papers	50%
		Coursework	50%
Technical subjects (mathematics, sciences) (leather technology)	:	Written papers	60%
		Coursework	40%
Practicals		Coursework	100%

M. Tech. and B.Tech.

General subjects (management, economics)	:	Written papers	60%
		Coursework	40%
Technical subjects (mathematics, science, etc.)	:	Written papers	70%
		Coursework	30%
Practicals	:	Coursework	100%

D. Course Organisation and Curriculum

For the purposes of this report it has been assumed that all courses except the Ph.D. course will:-

(i) last for 32 weeks

(ii) include 30 weeks of lectures and practicals and 2 weeks for examinations

It will be a local decision as to whether the academic year is to be divided into two semesters with examinations at the end of each semester or whether it is to be run as a one year course with examinations at the end of the year.

It is also suggested that some thought should be given to re-organising the examination system so that rather than one long end of subject examination students have shorter examinations at regular intervals throughout a subject. The advantages of such a scheme are:-

(i) earlier knowledge about students who are having difficulties with a course. Remedial action can then be taken avoiding problems later in the course.

(ii) avoids a large number of long examinations close together at the end of a course. This reduces tensions and examination pressures on students.

(iii) examination marking by staff is spread over the year and avoids the problem of staff having to mark hundreds of papers in a very short time.

As previously mentioned in Sections B and C it is the responsibility of the staff of the College of Technology, Calcutta, in co-operation with the University of Calcutta, to formulate the assessment procedure and allocation of marks for written examinations, coursework and practical work.

A curriculum for each of the courses listed in Section A is given in Sections E to J below.

Each subject in the curriculum of a course is given a code number which represents the course; the year and the subject. For example,

MT	M.Tech. in Leather Technology (2 years)
PGD	Postgraduate Diploma in Leather Technology (1 year)
BT	B.Tech. in Leather Technology (4 years)
D	Diploma in Leather Technology (3 years)
C	Certificate in Leather Technology (1 year)

E. Curriculum - Doctor of Philosophy(Ph.D.)

This is a three year course during which students carry out a major research investigation into an aspect of leather science or leather technology. There is no formal lecture course though it is suggested that students enrolled on the course might attend short courses at local universities. Subjects for further study might include:-

Statistics and computing
Biochemistry
Industrial management techniques

Choices for investigation should be selected in consultation with local industry and national research organisations (e.g. CLRI). It is suggested that the consultant invited to advise on research and production control should outline a five year research programme that would include topics for Ph.D. and M.Tech. studies as well as giving broad subject headings for B.Tech. projects.

It is important that thesis and projects done by students at the College of Technology, Calcutta, should form part of a well planned research programme and should not be haphazard choices decided at short notice. The year commitment to thesis and project work can be considerable and such an important resource should not be wasted because of lack of planning and haphazard management.

F. Curriculum - M.Tech. in Leather Technology

This is a two year course aimed at extending the knowledge of graduates holding a B.Tech. in Leather Technology. The course should concentrate on advances in analytical chemistry, natural products chemistry, synthetic polymers and dyestuffs. The course has an option in the first year to allow students who took the shoe and leathergoods option at B.Tech. level to do leather technology and effluents and by products. A similar option exists to allow the student who took the leather technology option at B.Tech. level to do shoe and leathergoods technology.

Course subjects (M.Tech. - Year 1 - 30 hours p.w.)

MT 1.1	Instrumental Analysis	Lectures	2 hrs pw
		Supervised Practical	2 hrs pw
MT 1.2	Physics and Chemistry	Lecture	1 hr pw
	of Biopolymers	Supervised Practical	2 hrs pw
MT 1.3	Physics and Chemistry	Lecture	1 hr pw
	of Synthetic Polymers	Supervised Practical	2 hrs pw
MT 1.4	Project A	Practical	6 hrs pw

plus personal tutorials (1 hr pw) covering these topics

EITHER

MT 1.5	Effluent Treatment and By products	Lecture	1 hr pw
		Practical	2 hrs pw
MT 1.6	Tannery Engineering and Machines	Lecture	1 hr pw
		Practical	2 hrs pw
MT 1.7	Leather Technology	Lectures	2 hrs pw
		Practical	4 hrs pw

plus personal tutorial (1 hr pw) covering these topics

OR

MT 1.8	Footwear and Leathergoods Engineering and Machines	Lecture Practical	1 hr pw 2 hrs pw
MT 1.9	Footwear and Leathergoods Technology	Lectures Practical	3 hrs pw 6 hrs pw

plus personal tutorial (1 hr pw) covering these topics

Course subjects (M.Tech. - Year 2 - 30 hours pw)

MT 2.1	Chemistry of Dyestuffs and Dyeing	Lectures Tutorial Practical	2 hrs pw 1 hr pw 2 hrs pw
MT 2.2	Colour Physics and Surface Coating	Lectures Tutorial Practical	2 hrs pw 1 hr pw 2 hrs pw
MT 2.3	Aspects of Fashion and Design	Lecture	1 hr pw
MT 2.4	Recent Advances in Leather Science and Technology	Lecture Tutorial	1 hr pw 1 hr pw
MT 2.5	Project B	Tutorial Practical	1 hr pw 16 hrs pw

G. Curriculum - Postgraduate Diploma in Leather Technology

This special one year course is designed as a converstion course for chemistry and chemical engineering graduates. The course should concentrate on leather manufacture and production control. The purpose of a course such as this is to encourage graduates from other disciplines into the leather industry and to strengthen the base knowledge of the industry in applied chemistry and chemical engineering.

Course subjects (Postgraduate Diploma)

PGD 1.1	Analysis of Process Chemicals, Liquors and Leathers	Lectures Practical	2 hrs pw 2 hrs pw
PGD 1.2	Physical Properties of Leather	Lectures Tutorial Practical	2 hrs pw 1 hr pw 2 hrs pw
PGD 1.3	Pigments, Polymers, Dyes, Fats and Polyphenols	Lecture Tutorial	1 hr pw 1 hr pw
PGD 1.4	Leather Science	Lectures Tutorial	2 hrs pw 1 hr pw
PGD 1.5	Leather Technology	Lectures Tutorial Practical	4 hrs pw 1 hr pw 8 hrs pw
PGD 1.6	Tannery Engineering and Machines	Lecture Practical	1 hr pw 2 hrs pw

H. Curriculum - B.Tech. in Leather Technology

This course is a four year course aimed at providing an in-depth treatment of leather manufacture production control and principles of management. Although the approach is more theoretical than the Diploma in Leather Technology it is emphasised that it is essential that students should receive a sound practical training with experience of making a wide range of leathers.

The course stresses the post-tanning and finishing stages of leather production as it is this aspect of the Indian leather industry which needs to be developed. It is expected that students gaining the B.Tech. qualification will be the technologists in the industry and their role will include developing new leathers and improving existing production. It is important that students receive instruction in experimental design and planning, statistics and computer analysis. The final year project should provide students with the opportunity to apply all aspects of the course (literature surveys; report writing; statistical design; laboratory and tannery practice; mathematical analysis; lecturing).

In addition, students should receive some training in shoe and leathergoods manufacture and by-products utilisation. However, it is important to realise that a student cannot be trained to be a shoe and leathergoods technician and a leather technologist in a four year course. The training of shoe and leathergoods technicians should be done in a separate Diploma in Footwear and Leathergoods Technology. There is no justification for offering B.Tech. and M. Tech. in Footwear and Leathergoods Technology.

If it is decided that graduates with a knowledge of shoe and leathergoods technology are required then this could be achieved in two ways:-

(i) the final year of the B.Tech. in Leather Technology could be offered as two options

Either (a) advanced leather technology and project

or (b) shoe and leathergoods technology (project time to be used for shoe and leathergoods manufacture)

(ii) special one year postgraduate diploma in shoe and leathergoods technology for students having a B.Tech. in Leather Technology

Course subjects (B.Tech. - Year 1 - 32 hrs pw)

BT 1.1	Humanities and General Studies	Lectures	2 hrs pw
		Tutorial	1 hr pw
BT 1.2	Mathematics 1 - General	Lectures	2 hrs pw
		Tutorial	1 hr pw

BT 1.3	Physics	Lectures	2 hrs pw
		Tutorial	1 hr pw
		Practical	2 hrs pw
BT 1.4	Chemistry	Lectures	2 hrs pw
		Tutorial	1 hr pw
		Practical	2 hrs pw
BT 1.5	Analytical Chemistry	Lectures	2 hrs pw
		Tutorial	1 hr pw
		Practical	2 hrs pw
BT 1.6	Engineering and workshop	Lectures	2 hrs pw
		Practical	2 hrs pw
BT 1.7	Technical Drawing	Practical	2 hrs pw
		Tutorial	1 hr pw
		Practical	2 hrs pw

Course subjects (B.Tech. - Year 2 - 32 hrs pw)

BT 2.1	Principles of Management I - General	Lecture	1 hr pw
BT 2.2	Mathematics II - Statistics	Lecture	1 hr pw
		Tutorial	1 hr pw
BT 2.3	Analysis of Process Chemicals,	Lectures	2 hrs pw
	Liquors and Leather	Practical	2 hrs pw
BT 2.4	Physical Properties of Leather	Lectures	2 hrs pw
		Tutorial	1 hr pw
		Practical	2 hrs pw
BT 2.5	Microscopy, Histology and Microbiology	Lecture	1 hr pw
		Tutorial	1 hr pw
		Practical	2 hrs pw
BT 2.6	Chemical Engineering I	Lectures	2 hrs pw
	- Unit Processes	Tutorial	1 hr pw
		Practical	2 hrs pw

BT 2.7	Electrical and Electronic Engineering	Lecture	1 hr pw
		Tutorial	1 hr pw
		Practical	1 hr pw
BT 2.8	Leather Technology II	Lectures	2 hrs pw
		Tutorial	1 hr pw
		Practical	5 hrs pw

Course subjects (B.Tech. - Year 3 - 32 hours pw)

BT 3.1	Personnel Management and Training	Lecture	1 hr pw
		Tutorial	1 hr pw
BT 3.2	Industrial Economics and Accounting	Lecture	1 hr pw
		Tutorial	1 hr pw
BT 3.3	Mathematics III - Computing	Lecture	1 hr pw
		Tutorial	1 hr pw
		Practical	1 hr pw
BT 3.4	Leather Science	Lectures	2 hrs pw
		Tutorial	1 hr pw
BT 3.5	Chemical Engineering II	Lecture	1 hr pw
		Practical	2 hrs pw
BT 3.6	Leather Technology III	Lectures	3 hrs pw
		Tutorial	1 hr pw
		Practical	8 hrs pw
BT 3.7	Footwear and Leathergoods Technology I	Lecture	1 hr pw
		Tutorial	1 hr pw
		Practical	5 hrs pw

Course subjects (B.Tech. - Year 4 - 32 hrs pw)

EITHER

BT 4.1	Principles of Management II - Tannery	Lecture	1 hr pw
		Tutorial	1 hr pw
BT 4.2	Tannery Engineering and Machines	Lectures	2 hrs pw
		Tutorial	1 hr pw
		Practical	2 hrs pw
BT 4.3	Effluent and By-products	Lecture	1 hr pw
		Practical	2 hrs pw
BT 4.4	Pigments, Polymers, Dyes, Fats and Polyphenols	Lecture	1 hr pw
		Tutorial	1 hr pw
BT 4.5	Leather Technology IV A	Lectures	3 hrs pw
		Tutorial	1 hr pw
		Practical	8 hrs pw
BT 4.6	Project	Tutorials	2 hrs pw
		Practical	6 hrs pw

OR

BT 4.7	Principles of Management II - Shoe & Leathergoods	Lecture	1 hr pw
		Tutorial	1 hr pw
BT 4.8	Footwear and Leathergood Engineering and Machines	Lectures	2 hrs pw
		Tutorial	1 hr pw
		Practical	2 hrs pw
BT 4.9	Pigments, Polymers, Fats, Dyes and Polyphenols	Lecture	1 hr pw
		Tutorial	1 hr pw
BT 4.10	Leather Technology IVB	Lecture	1 hr pw
		Tutorial	1 hr pw
		Practical	6 hrs pw
BT 4.11	Footwear and Leathergoods Technology II	Lectures	3 hrs pw
		Tutorials	2 hrs pw
		Practical	10 hrs pw

I - Curriculum - Diploma in Leather Technology

This course is a three year course aimed at providing a broad introduction to leather manufacture and production control for people who are likely to be employed as technicians. It is assumed that foreman will be selected from these trained technicians and that foremen must have some training skills so that they can impart knowledge to operatives and craftsmen. In some companies technicians may be employed as supervisors or department managers and so it is important that they have some basic management training and a knowledge of economics and accounts.

The emphasis of the course must be on practical work, the acquisition of practical skills and controlling production (throughput and quality).

Course subjects (Diploma - Year 1 - 36 hours pw)

D 1.1	Humanties and General Studies	Lectures 2 hrs pw Tutorial 1 hr pw
D 1.2	Mathematics I - General	Lectures 2 hrs pw Tutorial 1 hr pw
D 1.3	Chemistry	Lectures 4 hrs pw Tutorial 1 hr pw Practical 2 hrs pw
D 1.4	Physics	Lectures 2 hrs pw Tutorial 1 hr pw Practical 2 hrs pw
D 1.5	Leather Technology I	Lectures 3 hrs pw Tutorial 1 hr pw Practical 5 hrs pw
D 1.6	Engineering and Workshop	Lectures 2 hrs pw Tutorial 1 hr pw Practical 3 hrs pw
D 1.7	Technical Drawing	Lecture 1 hr pw Practical 2 hrs pw

Course subjects (Diploma-Year 2 - 36 hours pw)

D 2.1	Principles of Management - General	Lecture 1 hr pw
D 2.2	Mathematics II - Statistics	Lecture 1 hr pw
D 2.3	Leather Science	Lectures 3 hrs pw Tutorial 1 hr pw Practical 3 hrs pw
D 2.4	Analytical Chemistry	Lectures 2 hrs pw Tutorial 1 hr pw Practical 3 hrs pw
D 2.5	Microscopy, Histology and Microbiology	Lecture 2 hr pw Tutorial 1 hr pw Practical 2 hrs pw
D 2.6	Leather Technology II	Lectures 4 hrs pw Tutorials 1 hr pw Practical 6 hrs pw
D 2.7	Tannery Engineering and Machines	Lectures 2 hrs pw Tutorial 1 hr pw Practical 2 hrs pw

Course subjects (Diploma-Year 3 - 36 hours pw)

D 3.1	Personnel Management and Training	Lecture 1 hr pw Tutorial 1 hr pw
D 3.2	Industrial Economics and Accounting	Lecture 1 hr pw
D 3.3	Mathematics III - Computing	Lecture 1 hr pw Tutorial 1 hr pw Practical 1 hr pw
D 3.4	Footwear and Leathergoods Technology	Lectures 1 hr pw Tutorial 1 hr pw Practical 5 hrs pw

D 3.5	Production Control	Lectures 2 hrs pw Tutorial 1 hr pw Practical 4 hrs pw
D 3.6	Leather Technology III	Lectures 4 hrs pw Tutorials 1 hr pw Practical 6 hrs pw
D 3.7	Project	Tutorial 1 hr pw Practical 4 hrs pw

J. Curriculum - Certificate in Leather Technology

This course is a one year course aimed at providing an introduction to leather manufacture for people who are likely to be employed as operators and craftsmen rather than technicians and technologists.

The emphasis in the course must be on practical work and skills training and the lecture course must have a direct practical application. The Leather Science course should include basic physics, chemistry, histology and production control.

Course subjects (Certificate - one year - 36 hours pw)

C 1.1	Humanities and General Studies	Lectures 2 hrs pw
C 1.2	Mathematics and Statistics	Lecture 1 hr pw Tutorial 1 hr pw
C 1.3	Engineering and Workshop	Lectures 2 hrs pw Tutorial 1 hr pw Practical 4 hrd pw
C 1.4	Leather Science	Lectures 3 hrs pw Tutorial 1 hr pw Practical 4 hrs pw
C 1.5	Leather Technology	Lectures 4 hrs pw Tutorial 1 hr pw Practical 12 hrs pw

K. Courses in Footwear and Leathergoods Technology

In addition to the provision for Footwear and Leathergoods Technology which has been included in the Leather Technology courses it is suggested that a Certificate (1 year) and a Diploma (3 years) should be introduced when the facilities at Salt Lake City are complete. These two courses could be designed along similar lines to the courses in Leather Technology. In fact, the only alterations that need to be made are as follows:-

Diploma in Footwear Technology

(i) Replace D 1.5 (Leather Technology I) by Footwear and Leathergoods Technology I.

(ii) Replace D 2.6 (Leather Technology II) by Footwear and Leathergoods Technology II

(iii) Replace D 2.3 (Leather Science) by Footwear and Leathergoods Science

(iv) Replace D 2.7 (Tannery Engineering and Machines) by Footwear and Leathergoods Engineering and Machines.

(v) Replace D 3.4 (Footwear and Leathergoods Technology) by Leather Technology.

(vi) Replace D 3.6 (Leather Technology III) by Footwear and Leathergoods Technology.

Certificate in Footwear and Leathergoods Technology

(i) Replace C 1.4 (Leather Science) by Footwear and Leathergoods Science.

(ii) Replace C 1.5 (Leather Technology) by Footwear and Leathergoods Technology.

Detailed syllabi for Footwear and Leathergoods Science and Footwear and Leathergoods Technology should be decided by the Footwear and Leathergoods Consultant and College Staff.

L. Short Courses

In addition to the full time courses referred to in Sections A-K it is suggested that the College of Technology, Calcutta, should organise a series of short courses after consultation with local industry. These courses should be designed to meet retraining and updating needs of people already in industry. Most courses could be adapted to Leather, Footwear or Leathergoods personnel.

A list of possible short coures is given below:-

(i)	Training for Trainers	1 week
(ii)	Sorting and Grading	4 weeks
(iii)	Basic Effluent Treatment	4 weeks
(iv)	Introduction to Production Control	4 weeks
(v)	Basic Engineering and Machine Maintenance	12 weeks
(vi)	Induction Training	4 weeks
(vii)	Operator Training	12 weeks
(viii)	Training for Foremen and Supervisors	12 weeks
(ix)	Developments in Leather Finishing	6 weeks
(x)	Quality Control and Standisation	12 weeks
(xi)	Pattern Cutting	
(xii)	Village Leather Footwear and Leathergoods Production	12 weeks
(xiii)	Sewing Machine Operator Courses	6 weeks
(xiv)	Footwear and Leathergoods Design	12 weeks
(xv)	Basic Footwear and Leathergoods Manufacture	12 weeks
(xvi)	Materials Testing for Footwear and Leathergoods Personnel	12 weeks
(xvii)	Basic Leather Manufacture	12 weeks
(xviii)	Leather By-products	4 weeks
(xix)	Leather Dyeing	4 weeks
(xx)	Beamhouse and Tanning	4 weeks
(xxi)	Health and Safety	4 weeks

VI STAFF

At the present time the following numbers and designations of staff are on the payroll of the College of Leather Technology, Calcutta.

A. Existing Staff

Academic (teaching) staff

Principal	1
Professors (Leather Technology)	2
Full time lecturers (Leather Technology)	4
Full time lecturers (Applied sciences)	3
Full time lecturers (Boot and shoe and leathergoods)	1
Part time lecturers (Applied science; accounts, etc.)	Approx. 10 hrs p.w

Senior non academic staff

Chief tannery technician	1
Librarian	1
Storekeeper	1
Senior administrative officer	1

Other support staff

Office administration and accounts	16
Stores	6
Engineering workshop	2
Tannery	12
Laboratory	5
Boot and shoe department	8
Security	9
Caretaking	7
Principal's orderly	1
Total (academic and non academic staff)	**81**

B. Proposed Additional Staff

In addition to the 81 full time staff listed previously it is proposed to appoint three Assistant Professors:-

Assistant Professor (Information & Placement)	1
Assistant Professor (Leather Technology)	2

C. Contact Teaching Hours for Staff Teaching on General Degree and Diploma Courses

Under the deliberations of the Expert Committee of the All India Council for Technical Education on the revision of staff structure in Engineering Institutions (March 1972) it was suggested that teaching staff should have the following contact teaching hours per week.

B.Tech. Courses

Designation	Proposed Contact Hours	Proposed Staff Ratios	Actual Calcutta ratios
Principal	4	-	-
Professors	12	1	1
Assistant Professors	14	2	(1½)
Lecturers	16	4	4

(i) tutorials, practicals & drawing classes count as half contact hours. (2 hours teaching is equivalent to 1 hour contact)

(ii) class sizes : lectures 60
tutorials & practicals (Years 1 to 3) 20
tutorials & practicals (Year 4+) 15

(iii) average year length : 30-32 weeks at 30-32 hours per week. (900-1000 contact hours per year)

(iv) workshop (tannery and laboratory) instruction should be given under the supervision of a workshop Superintendent who should be at the level of an Assistant Professor. There should also be foreman instructors at the level of lecturers.

(v) a minimum of 10% of the teaching and supervisory staff should be released on secondment for retraining each year.

(vi) the Placement Officer should have a contact teaching programme not exceeding 5 hours per week.

Diploma Courses

Designation	Proposed Contact Hours	Proposed Staff Ratios
Principal	4	
Head of Department (Professor)	12	1
Senior Lecturer (Asst. Professor)	14	
Lecturers	16	3

(i) class sizes : lectures 60
tutorials, practical, etc. 20

(ii) average year length : 30-32 weeks at 34-36 hours per week
(1050 - 1150 contact hours per year)

(iii) a minimum of 20% of the teaching and supervisory staff should be released on secondment for retraining each year. The larger percentage at this level is in recognition of the importance of industrial updating.

Other conditions are as shown under (i) - (vi) above for B.Tech. courses.

D. Contact Teaching Hours for Staff Teaching on courses in Leather Technology

Doctor of Philosophy (Ph.D) - 3 years

It is assumed that students will work without direct supervision but that they will have four hours of tutorials per week.

Year 1	Tutorials	4 hours	equivalent to 6 hours contact
Year 2	Tutorials	4 hours	
Year 3	Tutorials	4 hours	

M.Tech. in Leather Technology - 2 years

Year 1	Lectures	8 hours	equivalent to 12 hours contact
	Tutorials and supervised practicals	8 hours	
	Unsupervised practicals	14 hours	
Year 2	Lectures	6 hours	equivalent to 10 hours contact
	Tutorials and supervised practicals	8 hours	
	Unsupervised practicals	16 hours	

Postgraduate Diploma in Leather Technology - 1 year

Students take lectures with M.Tech. and B.Tech. courses and practical work will be supervised with other practical groups. Special tutorials will be provided.

Lectures	12 hours	equivalent to 3 hours contact
Tutorials	6 hours	
Unsupervised practicals	12 hours	

B.Tech. in Leather Technology - 4 years

Year 1	Lectures	14 hours	equivalent to 23 hours contact
	Tutorials	6 hours	
	Practicals	12 hours	
Year 2	Lectures	12 hours	equivalent to 22 hours contact
	Tutorials	6 hours	
	Practicals	14 hours	
Year 3	Lectures	10 hours	equivalent to 21 hours of contact
	Tutorials	6 hours	
	Practicals	16 hours	
Year 4	Lectures	8 hours	equivalent to 20 hours of contact
	Tutorials	6 hours	
	Practicals	18 hours	

Diploma in Leather Technology - 3 years

Year 1	Lectures	16 hours	equivalent to 26 hours of contact
	Tutorials	6 hours	
	Practicals	14 hours	
Year 2	Lectures	14 hours	equivalent to 25 hours of contact
	Tutorials	6 hours	
	Practicals	16 hours	
Year 3	Lectures	10 hours	equivalent to 23 hours of contact
	Tutorials	6 hours	
	Practicals	20 hours	

Certificate in Leather Technology - 1 year

Lectures	12 hours]	
Tutorials	4 hours]	equivalent to
Practicals	20 hours]	24 hours of contact

Summary

Total contact teaching hours for all courses	:	215 hours
Total student numbers for all courses	:	85 - 100
Total staff required - Principal		1
Professors	:	2
Assistant Professors	:	4
Lecturers	:	8
Staff on secondment	:	2

If the College of Technology only grows to develop its courses at M.Tech. and Ph.D. levels then it will generate 115 hours of contact teaching and will need the following staff:-

Principal	:	1
Professors	:	2
Assistant Professors	:	2
Lecturers	:	4
Staff on secondment	:	1

E. Description of Academic Staff required in the enlarged College of Leather Technology, Calcutta

Principal	Director of Research	1
Professors	Leather Science	1
	Leather Technology	1
Asst. Professors	Information and Placements	1
	Chemical Engineering	1
	Leather Science - Laboratory supervisor	1
	Leather Technology - Tannery supervisor	1
Lecturers	Chemistry, Analytical Chemistry	2
	Physics and engineering	1
	Mathematics, statistics and computing	1
	Microbiology, histology & microscopy	1
	Management and economics	1
	Workshop practice and technical drawing	1
	Leather technology	2
	Boot and shoe and leathergoods	1

F. Description of Non-Academic Staff required in the enlarged College of Leather Technology, Calcutta

Library	Librarian	1
	Library assistant - catalogues	1
	Library assistant - AVA	1
	Clerical assistant	1
Tannery	Chief technician - beamhouse; tanning	1
	Chief technician - finishing	1
	Technicians - machine operators	3

Laboratories	Technicians -	chemistry	1
		analytical chemistry	1
		physics	1
		physical testing	1
		microbiology]	
		histology & microscopy]	1
		chemical engineering	1
		experimental tanning & dyeing	1
		byproducts	1
Workshop	Technicians -	woodwork	1
		metalwork	1
Effluent treatment	Technician		1
Stores	Storekeeper		1
	Assistants		2
Administration and Accounts	Senior administrative officer		1
	Accounts		2
	Secretarial; clerical		2
	Security		2
	Caretaking		4
	Gardening		2
Principal's office	Orderly		1
	Secretary		1

G. Staff required at Salt Lake City

When the Salt Lake City extension is opened and a Diploma in Footwear Technology and Leathergoods Manufacture begins there will be an additional need for both academic and non academic staff.

It is estimated that the following staff will be needed:-

Assistant Professor	1
Lecturers	3
Technicians	6
Library	2
Stores	2
Caretaking	2
Secretarial; clerical	2
General staff	2

H. Staff Retraining

It is essential that the College authorities take immediate action to start a programme of staff development and retraining. Such a programme should be seen as a major part of the strengthening of the College of Leather Technology, Calcutta and should be planned for five years ahead.

In the short term the following training placements should be arranged:-

(i) leather technology (to include effluent treatment)
(ii) leather analysis, testing and production control
(iii) tannery machinery and maintenance
(iv) microscopy, histology and microbiology
(v) foot technology
(vi) leathergoods technology
(vii) footwear and leathergoods design

In the longer term staff development should take place in the following areas:-

(i) chemical engineering, effluent treatment and by-products
(ii) instrumental analysis
(iii) dyes, dyeing and colour physics
(iv) polymers, surface coating and leather finishing
(v) fashion, design and marketing

I. Consultants

It is important that consultants in the following subjects should be appointed to this project if it is to have a successful conclusion. The list is given in order of priority.

(i)	tannery plant installation and maintenance	9 months
(ii)	practical leather manufacture (with emphasis on post-tanning and finishing)	4 months
(iii)	effluent treatment and by-products	1 month
(iv)	research and production control	4 months
(v)	footwear production	

If the research and production control consultant could also advise on microscopy, histology and microbiology this would be an advantage. However, in retrospect the training specialist feels that undue emphasis should not be put on microscopy, histology and microscopy and that consultant support in this area is a low priority.

VII FINAL NOTE

The training specialist would like to stress that he considers that it is essential that the alterations to the buildings of the College of Leather Technology, Calcutta, the re-equipment of the laboratories and tannery and the development of the Salt Lake City site should take place before the introduction of new courses in Leather Technology and Footwear and Leathergoods Technology.

It is also important that the retraining of present staff and the appointment of new specialist staff should be completed before the proposed new courses are started.

Proposals for the extension and updating of courses in Leather Technology and Footwear and Leathergoods Technology have been muted for almost twenty years and little action has been taken to date. There is now a real chance that major advances can be achieved but this will only be possible with new facilities and retrained staff. The new courses to be introduced must have a strong practical bias and this will not be possible without new buildings and equipment.

This present report contains recommendations on modernisation plans, equipment and curriculum for training programmes for the College of Leather Technology, Calcutta.

The syllabuses of the subjects covered in the curriculum in this report will be included in a supplementary publication under preparation and to be available in May 1985.

APPENDIX I

Programme of the Training Specialist during the six week Project period

20.8.84 to 22.8.84	Briefing at UNIDO, International Centre, Vienna, Mr J Buljan
23.8.84	Arrive Calcutta
24.8.84	Initial planning meeting with Dr H Rao (National Project Co-ordinator)
25.8.84	Preparation of outline plan of visits and meetings
26.8.84	Sunday
27.8.84	Discussions with Mr S Sen (Chairman of Governors of College of Technology, Calcutta) and Dr B Sen (Director of Technical Education, W. Bengal)
28.8.84	Tour of College of Leather Technology, Calcutta and meeting with teaching and technical staff
29.8.84	Discussion with Dr Z Kotazek, Technical Manager, BATA, India
30.8.84	Detailed study of laboratory facilities at College of Technology, Calcutta. Individual meetings with teaching staff
31.8.84	Discussions with Mr P T J Knaapen (Managing Director) and Mr S J Horinka (Technical Director-Deputy Managing Director) BATA, India
1.9.84	Attended Annual Conference of Indian Leather Technologists Association (ILTA) and spoke about proposals for re-developing the College of Leather Technology, Calcutta. Discussions with Mr R T Krishnan (Director of Central Leather Research Institute, Madras)
2.9.84	Visit to Volga Tannery, Ghulam Julani Khan Road. Visit to Bengal Tanning Industries, Ghulam Julani Khan Road
3.9.84	Detailed study of support facilities (lecture rooms, student areas, tutorial rooms, staff rooms) at the College of Leather Technology, Calcutta. Discussion with students.
4.9.84	Visit to BATA tannery, Batanagar. Further discussion with Mr S Sen and Dr H Rao
5.9.84	Detailed study of tannery facilities at College of Leather Technology, Calcutta

7.9.84	National Holiday
8.9.84	Visit to Bengal Engineering College
9.9.84	Sunday
10.9.84	Study day on syllabi from College of Leather Technology, Calcutta; Government Tanning Institute, Jullundur, Punjab; Institute of Leather Technology, Madras, Tamil Nadu.
11.9.84	Visit to the present extension centre of CLRI in Calcutta and to the new service laboratory to open in 1985. Visit to East Asia Skin Corporation, Tiretta Bazar Street
12.9.84	Meeting with Mr S Ghosh (Minister-in-charge, Higher Education, W. Bengal) and Dr B Sen (Director of Technical Education, W. Bengal) Visit to the University of Jadavpur
13.9.84	Discussion with Professor M Bannerjee (ex-Principal, College of Leather Technology, Calcutta) Visit to Calcutta Medical College
14.9.84	Study day on syllabi from Bengal Engineering College, Calcutta, W. Bengal; Muzaffarpur Institute of Technology, Muzaffarpur.
15.9.84	Visit to University of Visva Bharati
16.9.84	Sunday
17.9.84	Meeting with past students of the College of Leather Technology, Calcutta.
18.9.84	Discussions with Dr B Sen
19.9.84	Review of the first month of the project visit with Dr H Rao
20.9.84	Visit to the British Council and meeting with Dr J P Eyres (Assistant Education Adviser, Sciences) Visit to UNDP and discussion with Mr S K Dasgupta (Senior Officer)
21.9.84	Visit to offices of TATA Exports and discussions with Mr S G Iyengar (Manager) and Mr G Sadashir
22.9.84	Preparation of notes for final meeting with Dr B Sen
23.9.84	Sunday
24.9.84	Review of project, verbal presentation of main findings as presented in interim report (December 1984), discussion with Dr H Rao and Mr B Sen
25.9.84	Departure from Calcutta
26.9.84	De-briefing at UNIDO, International Centre, Vienna. Mr J Buljan.

27.9.84 to 28.9.84	Discussions at UNESCO, Paris and de-briefing, Mr S Daniels.
29.9.84	Holiday
30.9.84	Departure from Paris
17.12.84 to 18.12.84	Additional discussions and formulation of interim report at UNIDO.

APPENDIX II

Organisations visited by the Training Specialist during the Project period

United Nations Industrial Development Organisation, Vienna A1400 Austria
College of Leather Technology, Calcutta
BATA (India), Batanagar
Volga Tannery, Ghulam Julani Khan Road, Calcutta
Bengal Tanning Industries, Ghulam Julani Khan Road, Calcutta
Bengal Engineering College, Calcutta
CLRI Extension Centre, Tangra Road, Calcutta
East Asia Skin Corporation, Tiretta Bazar Street, Calcutta
University of Jadavpur, Calcutta
Calcutta Medical College
British Council, Shakespeare Sarani, Calcutta
TATA Exports Ltd, Chowringhee Road, Calcutta
University of Visva Bharati, Santiniketan, Birbhum
United Nations Development Programme, Calcutta
United Nations Educational Scientific and Cultural Organisation,
Paris 75700 France

APPENDIX III

People with whom the Training Specialist had discussions during the Project period

Mr J Buljan	UNIDO, Vienna
Dr H Rao	Principal, College of Leather Technology, Calcutta
Mr G Sadashiv	TATA Exports Ltd., Calcutta
Mr S Sen	Chairman of Governors, College of Leather Technology, Calcutta
Dr B Sen	Director of Technical Education, W. Bengal
Dr R Bhaumik	Special assistant to Dr B Sen
Sri S S Dutta	Professor, College of Leather Technology, Calcutta
Dr S K Sarkar	Professor, College of Leather Technology, Calcutta
Dr A Sen	Lecturer, College of Leather Technology, Calcutta
Sri G M D Banak	Lecturer, College of Leather Technology, Calcutta
Sri A K Mukerjee	Lecturer, College of Leather Technology, Calcutta
Sri S M Sanyal	Lecturer, College of Leather Technology, Calcutta
Sri S K Basu	Lecturer, College of Leather Technology, Calcutta
Sri J N Dutta	Lecturer, College of Leather Technology, Calcutta
Sri S Chakraborty	Lecturer, College of Leather Technology, Calcutta
Sri S Bose	Lecturer, College of Leather Technology, Calcutta
Sri M K De	Librarian, College of Leather Technology, Calcutta
Dr Z Kotazek	Technical Manager, BATA, India
Mr P T J Knaapen	Managing Director, BATA, India
Mr S K Horinka	Technical Director, BATA, India
Mr T S Krishnan	Director, CLRI, Madras
Mr M Rafique	BASF (India), Calcutta
Mr R R Sen-Gupta	Rochanika Enterprise, Calcutta
Mr R P Singh	Quinn (India), Calcutta
Mr A Alam	Volga Tannery, Calcutta
Mr J Ahmed	Bengal Tanning Industries, Calcutta
Mr J S Roy	General Secretary - ILTA
Dr A K Seal	Principal, Bengal Engineering College
Professor A K De	Vice Principal, Bengal Engineering College
Dr B C Basu	CLRI Extension Centre, Calcutta

Prof. D K Chathoras	Jadavphur University, Calcutta
Professor M Bannerjee	Ex-Principal, College of Leather Technology, Calcutta
Mr S Ghosh	Minister-in-Charge, Higher Education, W. Bengal
Mr G S Bannerjee	Permanent Secretary, Department of Education, W. Bengal
Dr J P Eyres	Assistant Education Adviser (Sciences) British Council
Mr S G Iyengar	Manager, TATA Exports Ltd, Calcutta
Mr F Schmel	UNIDO, Vienna
Mr S Daniels	UNESCO, Paris
Mr J Berg	UNIDO, Vienna
Mr S N Bose	Ex-student (1947) - industrial leathers
Sri D Mukharjee	Ex-student (1945) - consultant
Mr G N Hore	Ex-student (1944) - Khadi and Village Industries
Mr D Bannerjee	Ex-student - Diamond Shamrock (India)
Mr P C Paul	Ex-student - harness and saddlery leathers
Mr C R Gupta	Ex-student - ordnance factory
Mr A Chakraborty	Ex-student - technical adviser, fur dressing
Mr S K Sett	Ex-student - BATA Shoe Co Ltd
Sri S Guha	Ex-student - has his own tannery
Sri R N Das	Ex-student - research chemist
Sri S K Das Gupta	Ex-student - Colour Chem Ltd
Mr B R Das Gupta	Ex-student - consultant, Chinese Tanneries, Calcutta
Mr T Deb	Ex-student - has his own tannery
Mr D Saha	Ex-student - has his own tannery
Mr P K S Roy	Ex-student - has his own tannery
Mr A Bhaumik	Ex-student - has his own tannery and pigment factory
Mr S Das	Ex-student - BATA (India)
Mr B Roy	Ex-student - State Trading Corporation
Mr P Chowdhury	Ex-student - BASF (India)
Mr P B Sen	Ex-student
Mr B C Mazundar	Ex-student (1934) - retired
Mr S P Daz	Ex-student - customs appraiser
Mr R Choudhury	Ex-student - Stahl Chemicals (GB) Ltd
Mr N P Das	Consultant - ex Northampton (1954)

APPENDIX IV

Documents and Publications seen by the Training Specialist during the Project period

1. Seminar on Technical Education for the Leather Industry January 1964 CLRI (Madras) India
2. Background for the blue print on Education in the field of Leather Technology. January 1964 CLRI (Madras) India
3. Minutes of the meeting of the Expert Committee of the All India Council for Technical Education on the revision of staff structure in Engineering Institutions, March 1972.
4. Report of the Expert Committee of the Eastern Regional Committee on the proposal of the Government of W. Bengal to consolidate and develop the College of Leather Technology, Calcutta. January 1974.
5. Draft Syllabus for Diploma in Leather Technology, Institute of Leather Technology, Madras, Tamil Nadu
6. Syllabus for B.Tech, in Leather Technology, Perarigna Annar University of Technology and CLRI, Madras, Tamil Nadu
7. Syllabus for Diploma in Leather Technology, Government Tanning Institute, Jullundur, Punjab
8. Syllabus for B.Tech. in Leather Technology, University of Calcutta and the College of Leather Technology, Calcutta
9. Syllabus for Diploma in Leather Technology, Institute of Technology Muzaffarpur Bihar
10. Bulletin of Bengal Engineering College, Calcutta
11. Need for High Level Technology for Indian Leather Industry, J.Ind.Leath.Tech.Ass. 1976 24 351
12. Some Thoughts on the Rationalisation of Indian Leather Industry. J.Ind.Leath.Tech.Ass. 1984 32 14
13. Indian Leather Industry and its Future - a perspective. Leather Age 1984 6 1984
14. Recommendations on Training of Trainers for the Punjab Knitwear Facility DP/ID/SER.A/503 UNIDO/March 1984

15. Leather and Leather Products Industries Development
DP/URT/78/010/11-52/31.7.D UNIDO/February 1983

16. Assistance to the Tanzania Institute of Leather Technology
RP/URT/82/005/11-01 and 02/31.5A UNIDO/November 1983

17. Audio-Visual Techniques for Industry, Development and
Transfer of Technology Series No.6 UNIDO 1978

18. Report on a Mission to Calcutta, India from 8-11 October 1984
on Project DP/IND/82/025 - Strengthening of the College of
Leather Technology. J Berg. UNIDO

APPENDIX V

List of Specialist Books and Journals on Leather Science and Technology that should be available in the Library of the College of Leather Technology, Calcutta

Note: this list does not include general textbooks on such topics as mathematics, physics, chemistry, biology, general engineering, chemical engineering, mechanical engineering, technical drawing, etc., etc. Textbooks for these subjects should be selected from those available locally and most suited to the course content as decided by the teaching staff. Several copies of each textbook that is selected as a coursebook should be provided.

* These books are out of print.

Science and Technology of Leather Production

1. *Science for Students of Leather Technology. Editor R Reed
   Pergamon Press (1966)
2. *The Manufacture of Sole and Other Heavy Leathers. G H W Humphreys
   Pergamon Press (1966)
3. *Furskin Processing. H Kaplan
   Pergamon Press (1971)
4. Practical Leather Technology. T C Thorstensen
   Van Nostrand Rheinhold Co. (1984)
5. The Chemistry and Reactivity of Collagen. K H Gustavson
   Academic Press (1956)
6. The Chemistry of the Tanning Processes. K H Gustavson
   Academic Press (1956)
7. The Leather Technicians Handbook. J H Sharphouse (2nd Edition)
   LPA (1983)
8. The Chemistry and Technology of Leather.
   Editors: F O'Flaherty, W T Roddy, R M Lollar. Rheinhold Publishing Co.
   Vol.I (1956) Preparation for Tannage
   Vol.II (1958) Types of Tannages
   Vol.III (1962) Dyeing and Finishing of Leather
   Vol.IV (1965) Evaluation of Leather

9. Leather Technology Dictionary in Six Languages. IULTCS (1977)
10. International Glossary of Leather Terms. 2nd Edition ICT (1981)
11. Glossary of Leather Terms. British Standards. 2780:1983
12. Tanning of Hides and Skins. C J Lockhart-Smith & R G H Elliott TPI (1974)
13. A Fundamental Study of the Mechanism of the Deterioration of Leather Fibres. BLMRA (1963)
14. *Progress in Leather Science 1920-45. BLMRA (1945)
15. *Leather Industries Laboratory Book. H R Proctor (1898)
16. *Chemistry of Leather Manufacture. J A Wilson (1928)
17. *Chemistry of Leather Manufacture. G D McLaughlin (1945)
18. *The Principles of Leather Manufacture. H R Proctor (1922)
19. *The Chrome Tanning Process. E W Merry (1936)
20. *The Manufacture of Chrome Leather. M C Lamb (1923)
21. *Leather Dressing, Dyeing and Finishing. D Woodroffe (1953)
22. *Fellmongers Handbook. M S Carrie & F W Woodroffe (1960)
23. *Fundamentals of Leather Science. D Woodroffe (1948)
24. Physical Chemistry of Leather Making. K Bienkiewicz. Krieger 1983
25. Gloving, Clothing and Special Leathers. P S Briggs.G135 TPI (1981)
26. Check List for Fellmongers. BLMRA (1972)
27. Preparation and Alum Dressing of Rabbit Pelts on a Small Scale. I B Leach and J Barrett. G156 TPI (197)
28. Tanning of Hides and Skins: Memo No.1. ILO (1980)
29. Choice of Technique in Leather Manufacture. M M Huq & H Aragaw Scottish Academic Press (1981)
30. Modern Rational Pit-Drum Tannage of Vegetable Sole Leather. J Mosiewicz. Forestal International (1976)
31. Modern Rational Dyeing and Finishing of Vegetable Sole Leather J Mosiewicz. Forestal International (1983)
32. Survey of Modern Vegetable Tannage. TEPP (1974)
33. Manufacture of Upper Leathers. D H Tuck. G134 TPI (1981)
34. Tanning of Hides and Skins. UNIDO (1982) UNIDO/ILO Technical Memo No.1.
35. *The Chemistry of Vegetable Tannins. SLTC (1956)
36. Contributions to the Study of the Interactions in the System - Hide-Tannin-Dyestuff. G Otto. BASF (1960)
37. Leather - its origin and fabrication. I Julien & G Gavend. CTC (1977)

38. Bayer Manual for the Leather Industry. BAYER
39. Tanners Manual : Chrome Upper Leather. BASF
40. Tanners Manual : Vegetable Leather. BASF
41. Leather Dyers Manual. BASF
42. Leather Finishers Manual. BASF
43. Tanning - Dyeing - Finishing. BAYER
44. Leather. C H Spiers. Borax Consolidated Ltd (1965)
45. The Production of Light Leather. ICI
46. Pocket Book for the Leather Technologist. BASF

The histology of skin and chemistry of skin proteins

47. Hides, Skins and Leathers under the Microscope. BLMRA (1957)
48. The Fibre Structure of Leather. B M Haines.
The Leather Conservation Centre (1981)
49. Skin, Hide and Leather Defects. J J Tancous, W T Roddy & F O'Flaherty
Tanners Council Laboraratory (1959)
50. Biophysical Properties of the Skin. Editor: H R Elden
Wiley Interscience (1971)
51. Treatise on Collagen. General Editor: G N Ramachandran
Vol.I Chemistry of Collagen Editor: G N Ramachandran
Vol.II Biology of Collagen Editor: B S Gould
Academic Press (1968)
52. The Structure and Function of Skin. W Montagna and P F Parakkal
Academic Press 3rd Edition (1974)
53. Hair. M Ryder.
Studies in Biology No.41 : Institute of Biology. E Arnold (1975)
54. Collagen - the Anatomy of a Protein. J Woodhead-Gallaway
Studies in Biology No.117 : Institute of Biology. E Arnold (1980)

The history of leather making and leather conservation

55. Leather in Life, Art and Industry. J W Waterer. Faber & Faber (1946)
56. Leather and Craftmanship. J W Waterer. Faber & Faber (1950)
57. Leather. J W Waterer. A History of Technology Vol.II. Ch.5 pp 147-190
Oxford Clarendon Press (1967)
58. Spanish Leathers. J W Waterer. Faber & Faber (1971)

59. Ancient Skins, Parchments and Leather. R Reed. Seminar Press(1972)

60. A Guide to the Conservation and Restoration of Objects made wholly or in part of Leather. J W Waterer. G Bell & Sons Ltd(1972)

61. Leather Conservation - a Current Survey. Editor: J Jackman Leather Conservation Centre (1982)

62. Oils and Lubricants used on Leather. D H Tuck Leather Conservation Centre (1983)

63. The Conservation of Bookbinding Leather. BLMRA The British Library (1984)

64. Leather and the Warrior. J W Waterer. Faber & Faber (1983)

Leather statistics

65. World statistical Compendium for Raw Hides & Skins, Leather and Leather Footwear (1961-1982) F.A.O.

66. Footwear Raw Hides and Skins and Leather Industry in OECD Countries. OECD (1981)

67. World-Wide Study of the Leather and Leather Products Industry. UNIDO (1979)

68. Leather Guide - International Directory of the Industry. Benn (Annual)

Leathergoods, shoes and clothing

69. Leather Clothing - its Make-up and Dry Cleaning. BLMRA

70. Manual of Shoemaking. C W Clark's Training Department.

71. Leather. R Gibbs.

72. Leatherwork. I Hamilton-Head

73. Modern Pattern Cutting and Design. W B Patrick.

74. Footwear Constructions and Materials - a manual for shoe retailers (3rd Edition) SATRA

75. Modern Leather Design. D Willcox.

Analysis of leathers, process chemicals and process liquors

76. Official Methods of Analysis of the Society of Leather Technologists and Chemists (1981)

77. Laboratory Course in Dyeing. C H Giles. SDC (2nd Edition 1971)

78. Acceptable Quality Levels in Leather UNIDO (1976)

79. Methods of Test for Colour Fastness of Textiles & Leather. British Standard BS1006:1978
Amendment No.1 (3457)
No.2 (3710)
No.3 (3959)
No.4 (4270)

80. Chemical Testing of Leather. British Standard 1309:1974
Amendment No.1 (2638)

81. Methods of Sampling & Physical Testing of Leather. British Standards BS3144:1968
Addendum 1 1981: Determination of Resistance to Bending & Abrasion of Heavy Leather.
Addendum 2 1981: Measurement of Water Vapour Absorption.

82. Standard Methods for Analysis of Oils, Fats and Derivatives. 6th Edition.

Journals

Journal of the Society of Leather Technologists and Chemists.
Journal of the American Leather Chemists Association.
Leather
Leather Manufacture
Leather Science
The Tanner
The Indian Leather Technologist
Journal of the Indian Leather Technologists Association.

Book numbers 4 to 12; 24 to 33; 47 to 49; 69 to 75; 76 to 82; are available from the Nene College Bookshop, Nene College, Moulton Park, Northampton NN2 7AL

APPENDIX VI

List of Audio Visual Aids (Hardware) that should be available in the College of Leather Technology, Calcutta

(See APPENDIX IV.17)

Lecture rooms

Blackboard (or whiteboard)

Whitescreen (portable)

Overhead projector (plus angled wall mounted screen)

Blackout facilities

Seminar room

Mobile blackboard (or whiteboard)

Video cassette recorder and visual display unit (VDU)

Film projector (Super-8 and 16mm)

Slide and film strip projector (35mm)

Slide-cassette tape projector (includes rear projection)

Television

Episcope

Cassette recorder

Whitescreen (portable)

Overhead projector

Blackout facilities

Dark room

Standard equipment for developing and printing

Super-8 camera plus sound

35mm-reflex camera)
Polaroid camera) compatible with light microscope
)

APPENDIX VII

List of Specialist Laboratory Equipment for Leather Analysis and Testing that should be available in the College of Leather Technology, Calcutta and Salt Lake City

NOTE: this list does not include general glassware and basic laboratory equipment such as bungs, bunsen burners, etc., etc.
Details of tests and equipment including suppliers can be found in the relevant British Standards (Appendix V. 76-81)

Analytical laboratory (Canal Road South site)

Analytical balances (0.1mg)	3
Hot air oven (air circulation)	1
Vacuum oven and pump	1
Twelve position water bath	2
Temperature controlled water bath	1
Vacuum line and pump	1
Semi micro Kjeldahl digestion (6 place)	2
Macro Kjeldahl digestion unit (6 place)	1
Macro Kjeldahl distillation unit (6 place)	1
pH meters (0.05 unit)	3
Muffle furnace (to 800^{o}C)	1
Six place reflux unit with mantle heater	1
Six place soxhlet and Dean and Stark unit with mantle heater	1
Cutter mill for grinding leather	1
Humidity control cabinet	1
Shake machine (50±10 cycles per minute)	1
Stainless steel lined fume cupboard	2
Standard (SLTC) hide powder	
Prechromed hide powder	
Filter candles for vegetable tannin analysis	6
Colorimeter (absorptiometer)	1
Spectrophotometer (visible and ultraviolet)	1
Bench centrifuge	1
Water still	1
Deioniser	1

Analytical and colour physics laboratory (Salt Lake City site)

As for Canal Road South site plus:-

Atomic absorptiometer	1
Infra-red spectrophotometer	1
Gas chromatograph	1
Higher pressure liquid chromatograph	1
Flame photometer	1
Selective-ion equipment	1
Surface colorimeter	1
Paper, column & thin layer chromatography equipment	various
Experimental dyeing machine	1

Physical testing laboratory (Canal Road South site)

Tensile strength machine (Hounsfield or SATRA)	1
Conditioning cabinet (variable humidity)	1
Thickness measuring gauge	2
Index of indentation gauge	1
Resistance to grain crack - sole leather	1
Lastometer	1
Instant lastometer	1
Dome plasticity apparatus	2
SATRA flexometer	1
Surface shrinkage by immersion in boiling water	1
Measurement of shrinkage temperature	6
Kubelka apparatus	4
Bally dynamic waterproofness tester - light leather	1
Waterproofness testing for gloving leather	1
Adhesion of finish to leather	1
Colour fastness to light - daylight	1
Grey scales: staining and colour transfer	2 each
Blue wool standards	various
Colour fastness to dry cleaning	1

Waterbaths - controlled	3 - various
Fastness to heat of coloured leathers	1
SATRA rub fastness tester	1
Large illuminated magnifying lens	1

Physical testing laboratory (Salt Lake City site)

As for Canal Road South site plus:-

Two dimensional stretch apparatus	1
Bally Flexometer	1
Scuff resistance tester	1
Bally dynamic waterproofness tester - sole leather	1
Water vapour permeability tester	1
Veslic rub fastness tester	1
Colour fastness to light - xenon	1
Instron tensile strength machine	1
Maeser waterproofness tester	1
Sole leather abrasion machine	1

APPENDIX VIII

List of Specialist Equipment and Machinery that should be available in the Tannery and Project Laboratories in the College of Leather Technology and Salt Lake City, Calcutta

NOTE: this list does not include basic items such as horses, tables, small pits, scales, etc., etc. (see Chapter I.B 2; 3

Careful consideration should be given to the type of equipment and machinery to be installed in a training centre and the following factors should be taken into account:-

(i) is the equipment robust and will it give good service in the hands of inexperienced operators ?

(ii) is the equipment easily repaired with basic workshop facilities ? As a general rule avoid sophisticated computer controlled equipment. As a preference select mechanically driven machines wherever possible.

(iii) in a training centre you want to be able to see the working parts of a machine and the action of the machine.

(iv) it is almost impossible from cost considerations for a training centre to keep replacing current machines with new machines ! Trainees must visit tanneries to see new machines and the training centre must have a range of basic machines for student use. The importance of working with a new machine in a training centre is often overstressed. There are so many different machines available that it is unlikely that a trainee will be using the same machines in a tannery as he used in the training centre even if the machines are new. Many new machines may be unsuitable for training purposes - they work too rapidly; they need constant adjustment, etc.

(v) most training centres find it easier to work on light weight raw materials - sheep, goat, pig, cattle (15-20 kg) and this means that the working width of machines can be limited to 1500 mm.

Main tannery (Canal Road South site)

Drums (21) : stainless steel (or perspex) is preferred as it is easier to clean the drums between processes. Flexibility of use is very important. The drums should have variable speed, individual motors and be heated. Facilities should exist on some drums for monitoring pH and temperature.
'Dosemat' (type VG1) with heated water jacket would be suitable.
Eight wooden drums already exist.
One 'Dosemat' stainless steel drum (Type VG) (1400mm x 600mm) has been purchased. This should be installed in the proposed experimental vegetable tan area.

Paddles (5) : covered wooden paddles are preferred and the paddles should be heated.
Local construction would be suitable.
One paddle already exists - this should be installed in the proposed experimental beamhouse area.
Heater required.

Fleshing machine (1) already purchased; local construction; needs to be installed.

Samming machine (1) purchase required; local construction possible.

Setting machine (1) purchase required; local construction possible.

Splitting machine (1) already purchased and installed; requires relocation in new position.
Needs to be commissioned.

Shaving machine (1) 'Flamar' (600mm width) machine has been purchased.
Needs to be installed and commissioned.

Vacuum drier (1) 'Incoma' (2300mm x 1300mm) machine has been purchased.
Needs to be installed and commissioned.
Steam from baby boiler.

Toggle-plate drier (1)	'Poletto' machine has been purchased. Needs to be installed and commissioned. Steam from baby boiler.

Finishing section (Canal Road South site)

All machines need to be installed in the finishing section after existing machinery is removed.

Slocombe (jaw) staking machine (1)	already purchased
Hand stakers (3)	to be manufactured locally.
Buffing machine (2)	300mm Turner type oscillating cylinder buffing machine. To be manufactured locally or purchased second hand.
Slow buffing wheel (1)	to be manufactured locally.
Overshot buffing wheel (1)	to be manufactured locally.
Spraying unit (1)	'Poletto' (3000mm x 2000mm x 3000mm) hand spray unit with four guns already purchased. Connect to existing compressors.
Airing-off cabinet (1)	to be manufactured locally.
Hydraulic press (1)	'Mostardini' (1370mm x 660mm) press has been purchased.
Ironing machine (1)	'Finiflex' type machine (Mercier) would be suitable. Important for finishing fashion leathers.
Pinwheel measuring machine (1)	second hand machine suitable; purchase locally.
Rolling machine (1)	instal existing D-type sole leather machine from the main tannery.
Reptile glazing machine(1)	already purchased.

Inclined bed glazing machine (1)	already purchased.
Small spray booth (1)	experimental DeVilBis booth (600mm x 600mm x 600mm) with integral compressor would be suitable

Experimental tanning and dyeing laboratory (Canal Road South site)

Shake machines (3)	to be manufactured locally (see I.B.16)

Project laboratory (Salt Lake City)

Drying cabinet (1)	to be manufactured locally (3000mm x 2000mm) to hold toggle frames and glass plate and hanging space.
small spray booth (1)	as for finishing section above.
small splitting machine(1)	for splitting leather for layerwise analysis. A shoe room skiving machine would be suitable.
Shake machines (3)	as for experimental tanning and dyeing laboratory.
Drums - 1200mm x 600mm (2) 600mm x 300mm (3)	as for main tannery above

APPENDIX IX

List of Specialist Equipment for Non Leather Workshops and Laboratories

Machinery maintenance & workshop (Canal Road South site)

Gas and arc welding	1 each
Woodwork lathe	2
Centre lathe (metal)	2
Anvil and forge	1
Piller drill	1
Shaping machine	1
Milling machine	1
Moulding equipment	1
Hammer drill and stand	2
Sheet metal cutter	1
Circular saw	1
Metalwork bench	2
Woodwork bench	2
Grinding wheel	1
Band saw machine	1
Hacksaw machine	1

Chemical engineering - unit operations (Canal Road South site)

In addition to the specialist experimental equipment provided in this laboratory area students should also use the tannery, the effluent treatment area and the byproducts laboratory as practical working examples of chemical engineering operations. For example, the tannery uses pumps, heat exchangers, steam raising equipment, valves, etc; the byproducts laboratory uses steam kettles,evaporators, filter presses, mixers and grinders; the effluent treatment area has pumps, screens, sieves, settlement (sedimentation) tanks, etc. Every opportunity should be taken to relate theory to practical application.

Many of the unit operations in a chemical engineering laboratory can be effectively illustrated using 'Quickfit' type glass assemblies in which the size of the reaction vessel is limited to five to ten litres.

Hydrostatic bench	1
Fluid flow apparatus	1
Pumps, valves, fans	various (tannery)
Heat exchangers	various (tannery)
Evaporators	various (by products)
Steam kettle and poker	by products
Steam boiler	tannery
Refrigeration equipment	1
Freeze drying apparatus	1
Ovens and air driers	various (laboratories)
Distillation apparatus	1
Reflux apparatus	1
Liquid-liquid and solid-liquid extractors	1 each
Glass reaction vessels (2 litre - 10 litre)	various
Filter press	by products

By products laboratory (Canal Road South site)

In addition to specialist equipment provided in this laboratory other facilities exist in the tannery and chemical engineering laboratory.

Pits (for sedimentation)	various (tannery)
Portable filter press (hair, precipitated protein)	1
Drum (for batch washings - hair recovery)	1 (tannery)
Steam kettle (gelatin extraction)	1
Digester (gelatin, grease)	2
Evaporator (with vacuum facilities)	1
Solvent recovery unit (grease)	1
Grinders for dry protein	1
Sieves	various

APPENDIX X

List of Universities and Colleges offering M.Tech., Ph.D., B.Tech. and Diplomas in Leather Technology

Ph.D. and M.Tech. in Leather Technology

(i) Perarignar Anna University of Technology, Madras,in with CLRI, Madras, Tamil Nadu.

(ii) Harcourt Butler Technical Institute, Kanpur, in association with the Government Leather Institute, Kanpur Uttar Pradesh

(iii) University of Calcutta in association with the College of Leather Technology, Calcutta.

(NEW COURSE : START DATE 1986-87)

B.Tech. in Leather Technology

(i) Perarignar Anna University of Technology, Madras,in association with CLRI, Madras, Tamil Nadu

(ii) Harcourt Butler Technical Institute, Kanpur, in association with the Government Leather Institute, Kanpur, Uttar Pradesh.

(iii) University of Calcutta, in association with the College of Leather Technology, Calcutta.

(iv) Institute of Technology, Muzaffarpur, in association with the Government Tanning Institute, Muzaffarpur, Bihar.

(NEW COURSE - START DATE 1985-86)

Diploma in Leather Technology

(i) Institute of Leather Technology, Madras, Tamil Nadu.

(ii) Government Leather Institute, Kanpur, Uttar Pradesh.

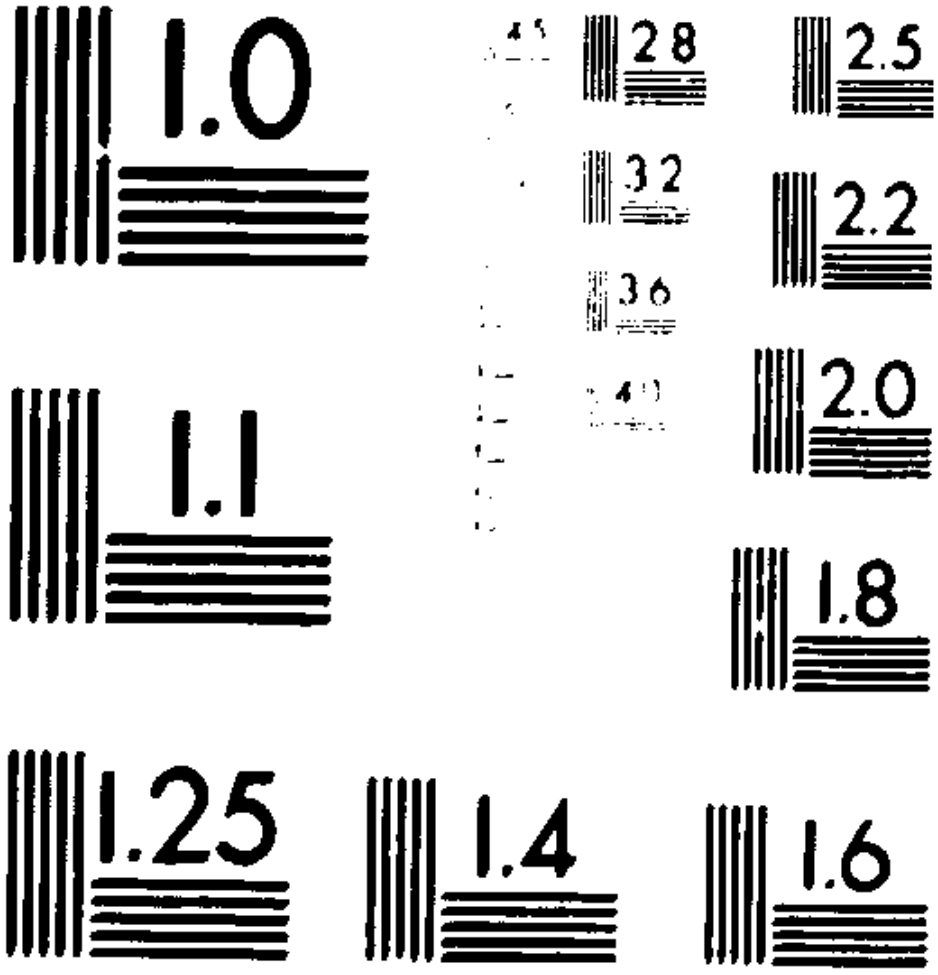
(iii) Government Tanning Institute, Jullundur, Punjab

(iv) Government Leather Insitute, Agra, Uttar Pradesh.

(v) Government Tanning Institute, Bombay, Maharashtra

(vi) Government Tanning Institute, Muzaffarpur, Bihar.

(vii) Government Tanning Institute, Hyderabad, Andhra Pradesh.



APPENDIX XI

Useful Addresses for Organisations and Product Suppliers referred to in this Report

NOTE: The majority of addresses referred to in this report can be found in the Leather Guide (Appendix V. No.68) The Leather Guide is published annually and is an essential book for any reference library serving the leather industry. The addresses below are not in the Leather Guide (1984). Addresses for test equipment can be found in British Standards and Official Methods of SLTC (Appendix V. 76-81)

1. SLTC
   3 Branch Lane
   Huddersfield HD2 2ED
   U.K

2. Leather Manufacturer
   Shoe Trades Publishing Co.
   P O Box 198
   Cambridge
   MA 02140
   U.S.A.

3. Leather Conservation Centre
   Leather Trade House
   Kings Park Road
   Moulton Park
   Northampton NN3 1JD
   U.K

4. Scottish Academic Press
   33 Montgomery Street
   Edinburgh EH7 5JX
   Scotland

5. Oxford University Press
   Ely House
   37 Dover Street
   London W1

6. Seminar Press
   24-28 Oval Road
   London NW1

7. Academic Press
   Berkeley Square House
   Berkeley Square
   London W1

8. Edward Arnold
   25 Hill Street
   London W1X 8LL

9. Faber & Faber
   3 Queen Square
   London

10. G Bell & Sons Ltd
    6 Portugal Street
    London WC2

11. The British Library
    Reference Division Publication
    Great Russell Street
    London WC1B 3DG

12. Benn Publication Ltd
    Sovereign Way
    Tonbridge
    Kent TN9 1RW
    U.K

13. Pergamon Press
    Headington Hill Hall
    Oxford
    U.K

14. SDC
    PO Box 244
    Bradford
    Yorkshire BD1 2JB
    U.K

15. Wiley Interscience
    605 Third Avenue
    New York NY10016
    U.S.A.