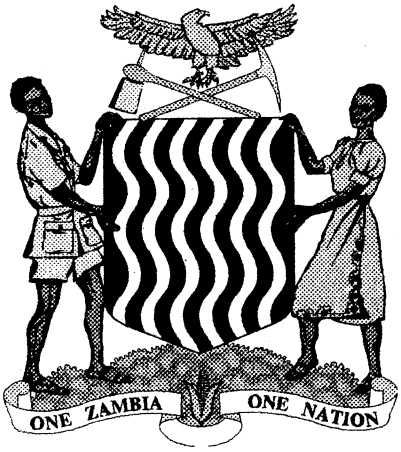

MAINTENANCE MANUAL

Government of the Republic of Zambia

for use by
Communities

Social Recovery Project
Microprojects Unit
Ministry of Finance and Economic Development

THIS MANUAL WAS PREPARED FOR THE SOCIAL RECOVERY PROJECT OF THE MICROPROJECTS UNIT BY:

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MAINTENANCE MANUAL

PREFACE

Over the past decade the Government of the Republic of Zambia has increased funding in the building and rehabilitation of health centres, schools, water and sanitation projects and community roads. Over the same period it has been noticed that existing and new structures are suffering from general neglect, little maintenance and are deteriorating quickly.

This is happening for a number of reasons:

- Government policy on maintenance is not clear
- Ownership and responsibility is uncertain
- Little training and no guidelines for maintenance
- Sufficient funds are not available
- Security is poor and vandalism is rife
- Use of poor quality materials and poor workmanship during construction

We need to know how to provide training and technical information on how to maintain our structures.

This maintenance manual provides a guide on how to organise and carry out maintenance. This maintenance Manual can be used with the Project Implementation Manuals (P.I.M.) Volumes 1 and 2.

We hope that this manual will help you keep your assets in good condition, so that they last a long time and serve you and your children well.

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CHAPTER 1
WHAT IS MAINTENANCE?

- DEFINITIONS
- WHAT THIS MAINTENANCE MANUAL IS FOR
- WHY DO WE HAVE TO MAINTAIN?
- MAINTENANCE VS REHABILITATION
- THE 4 ESSENTIALS FOR GOOD MAINTENANCE

CHAPTER 1 WHAT IS MAINTENANCE?

DEFINITIONS

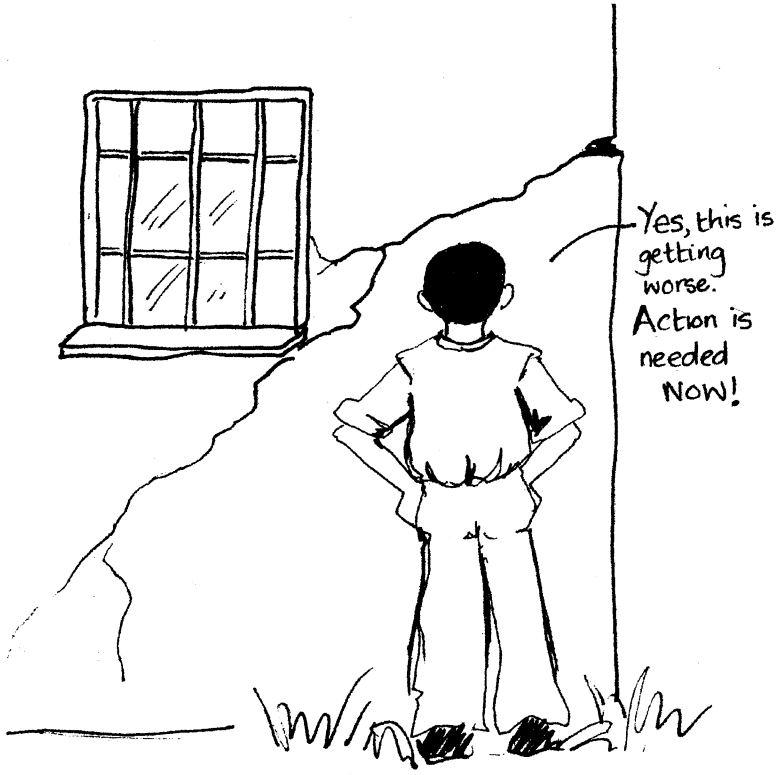
Maintenance is actions, which keep an item in good condition, including cleaning.

There is: -

Routine Maintenance, which is **planned** maintenance actions carried out at **regular** intervals, weekly, monthly or yearly.

This may include, for example, routine clearing of drains and gutters, painting walls, floors, window and door frames, applying ant poison, changing doors and locks, repairing wall cracks, slashing grass areas, and emptying septic tanks.

And: -

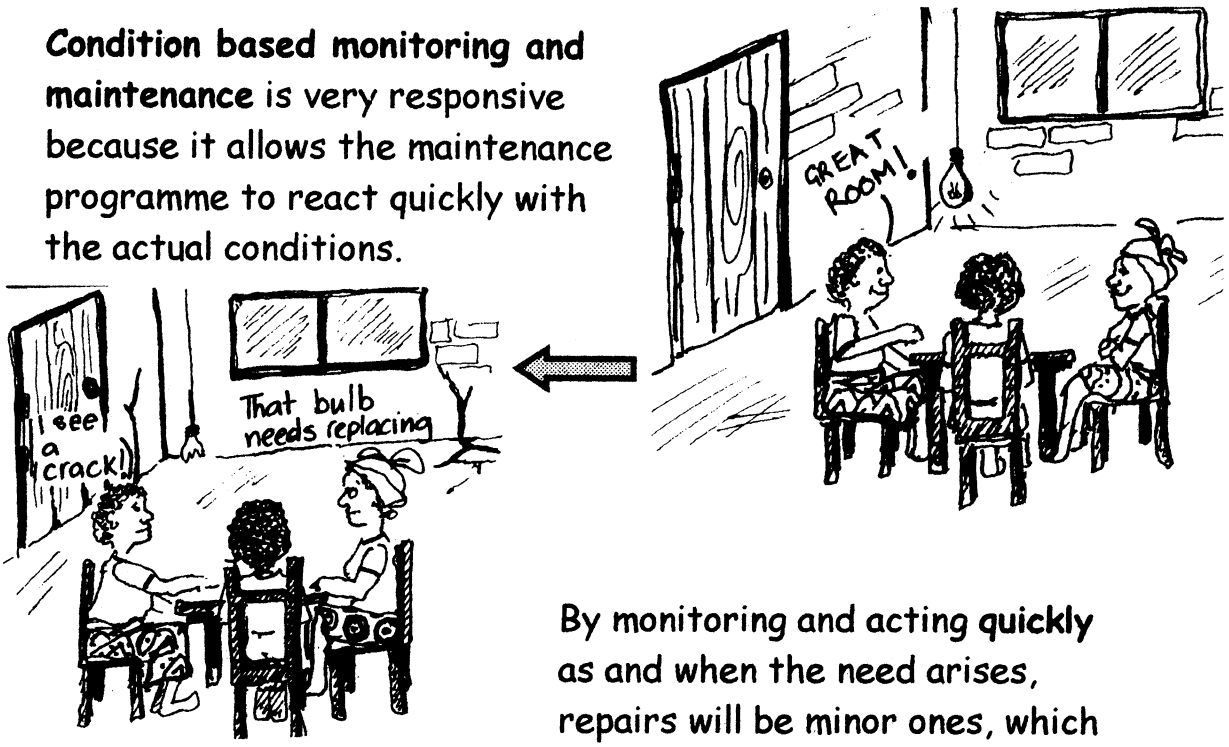


Condition based monitoring and Preventative Maintenance, which is the actions to keep an item in good condition as a result of **regular monitoring** and **observation, detection** and **prevention** of failure.

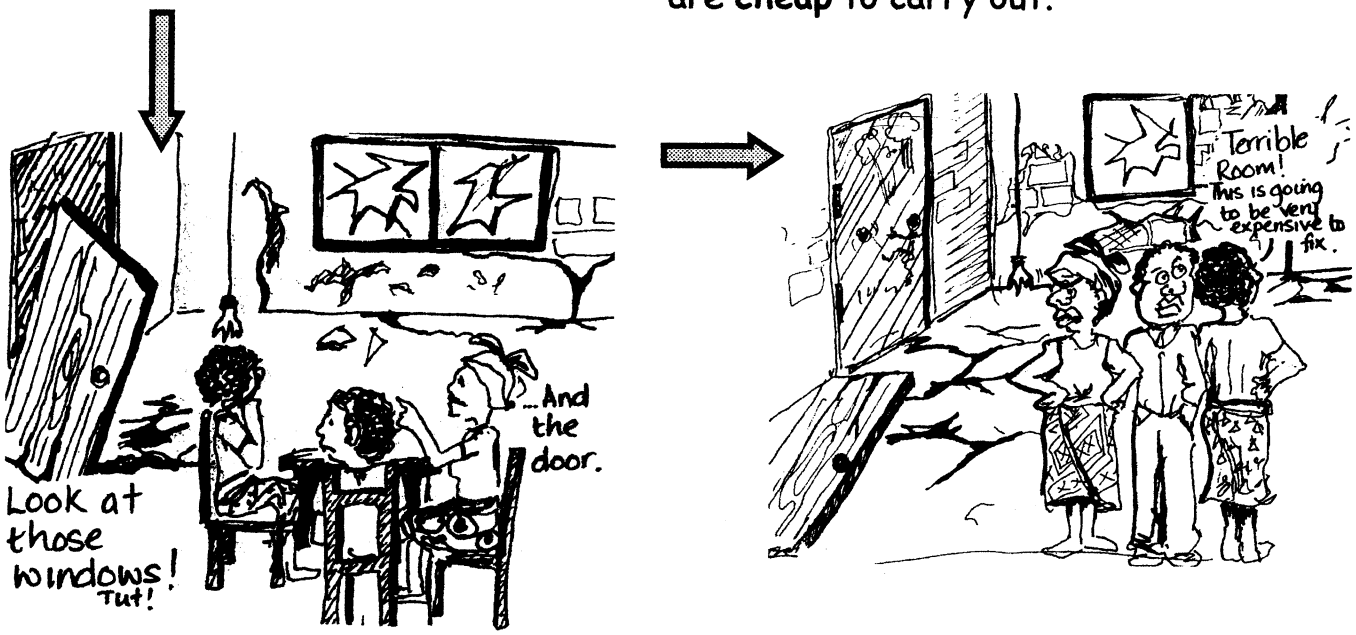
This may include, for example,
tightening loose screws in a desk **before** it breaks,
replacing door hinges **before** the door falls off, re-fixing toilet seats that have become loose, patching wall or floor cracks **before** they become serious holes, replacing missing screws in mortise locks **before** the lock becomes damaged or falls apart, replacing tap washers **as soon as** the tap starts leaking, and cistern handles **as soon as** they fall off.

Condition Based Monitoring is the **daily continuous** inspection of the parts of the structure to check on their condition and find out if there is a need for maintenance, i.e. see if there is a problem, find out what the cause is and, and fix it, **as and when it is necessary.**

Condition based monitoring and maintenance is very responsive because it allows the maintenance programme to react quickly with the actual conditions.



By monitoring and acting **quickly** as and when the need arises, repairs will be minor ones, which are **cheap** to carry out.



Constant on-going `condition based monitoring` is essential to effect `preventative maintenance`.

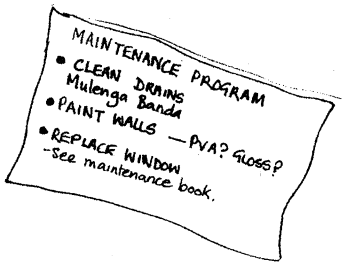
Problems that are **left too long** will become major repairs that will be **expensive.**

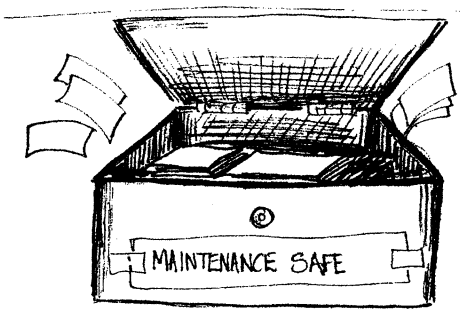
WHAT THIS MAINTENANCE MANUAL IS FOR?

This Maintenance Manual is to help you plan and carry out routine and condition based monitoring and preventative maintenance.

It is made up of two main parts,

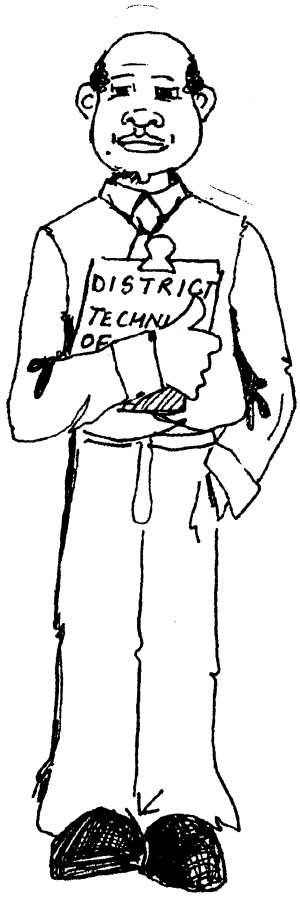
1. PLANNING MAINTENANCE AND PAYING FOR IT.





2. TECHNICAL HELP.

If you have implemented a project supported by **M.P.U.** then you should have **the Project Implementation Manuals (P.I.M.) Volumes 1 and 2**



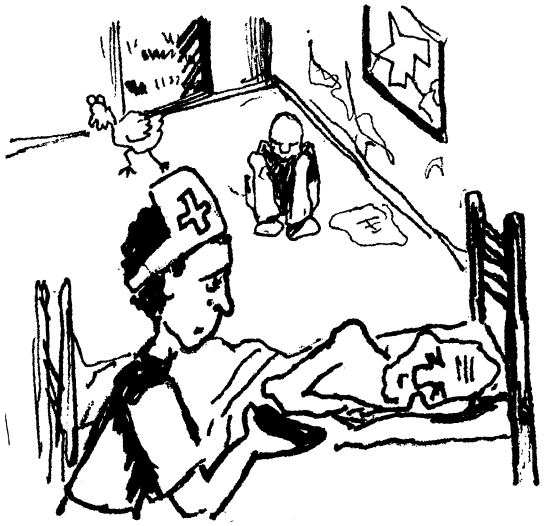
The Maintenance Manual can be used with the **P.I.M. Volumes 1 and 2.**

These three manuals will help you to **Manage, Construct** and **Maintain** your **ASSETS.**

WHY DO WE HAVE TO MAINTAIN?

Your building or structure is an asset to the whole community and will serve you well, as long as it is in good condition. To keep your structure in good condition, it has to be looked after or maintained.

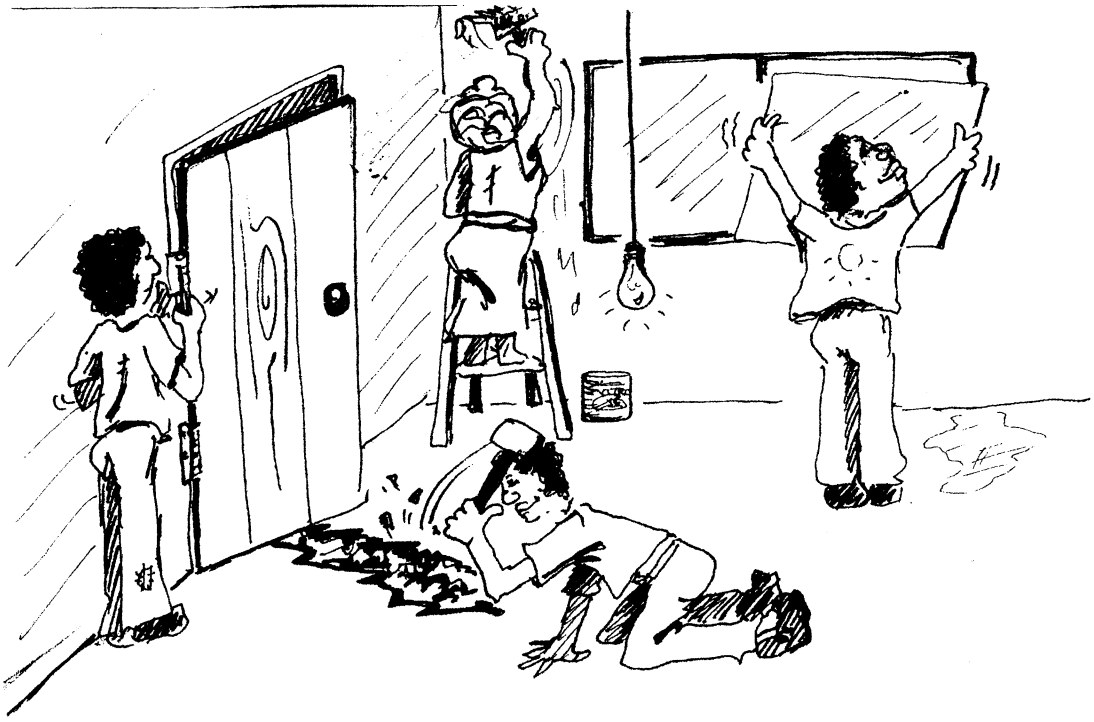
Your teachers can not teach your children well in classrooms that leak, have broken desks and chairs, or wind and dust blowing through broken windowpanes.



Your Health Centre staff can not do their best and cure your family in run down wards with no beds or blankets, broken doors, peeling paint, leaking toilets and taps.

Buses and trucks will soon become damaged or broken down and will not come to your village on badly pot holed, flooded roads, serving the rural areas.

Maintenance keeps your assets in good repair and prevents the need for costly rehabilitation after many years of neglect. **Now** is **always** the time to maintain, **not later**, and **every one can help**.



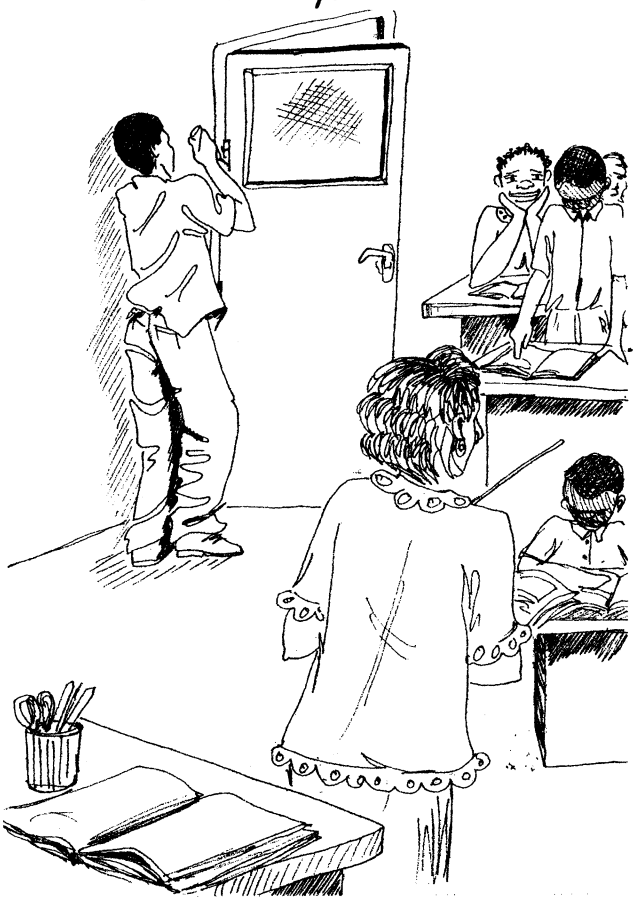
WORK TOGETHER TO MAINTAIN AND SAFE GUARD YOUR ASSETS. THEY ARE VALUABLE TO YOU, YOUR FAMILY AND YOUR FRIENDS.

MAINTENANCE VERSUS REHABILITATION

Rehabilitation is to restore or reinstate an item to its original condition, in order that it may be used for its intended purpose.

Rehabilitation is major work, which is required because maintenance has been neglected for a long time. Rehabilitation is **expensive**. Rehabilitation means that you can not use your building or road until it has been rehabilitated.

Constant on-going monitoring and maintenance will ensure that the work needed at one time is small and manageable and that expensive rehabilitation will not be necessary.



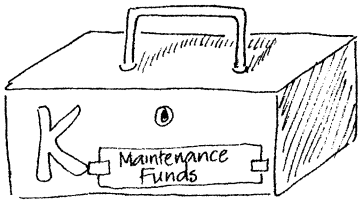
Maintenance can be carried out at any time with out causing inconvenience.

THE 4 ESSENTIALS FOR GOOD MAINTENANCE

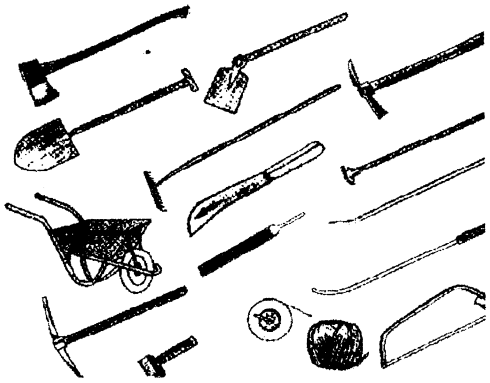
There are 4 things that you need for good maintenance.

1 **Organisation and Teamwork**
A maintenance committee manages the maintenance. The committee and community should always work together to carry out maintenance.

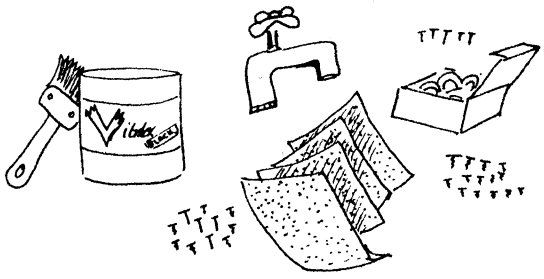
2 **Funds** must be raised and managed well so that when money is needed for maintenance, it is already there.



3 **Tools** The right tools must be on hand to carry out the work. If your tools are well looked after, they will last a long time.



4 **Materials** Good quality materials should be bought with your funds or collected from the community, to ensure that they are of good quality and that they will last a long time.



CHAPTER 2

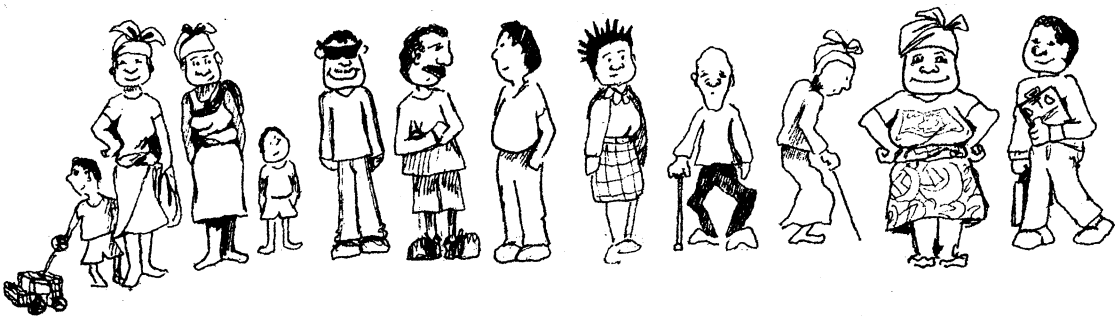
PLANNING AND ORGANISING MAINTENANCE

- INTRODUCTION
- TEAMWORK
- ORGANISING THE COMMITTEE
- MAINTENANCE COMMITTEE FUNCTIONS
- HOW TO HOLD A COMMITTEE MEETING

CHAPTER 2 PLANNING & ORGANISING MAINTENANCE

INTRODUCTION

Maintenance activities do not just happen. They have to be planned and organised.
The community must meet and elect a **Maintenance Committee**
The Maintenance Committee must **plan** and **organise** the maintenance.



Everyone in the community has a role to play

The community must

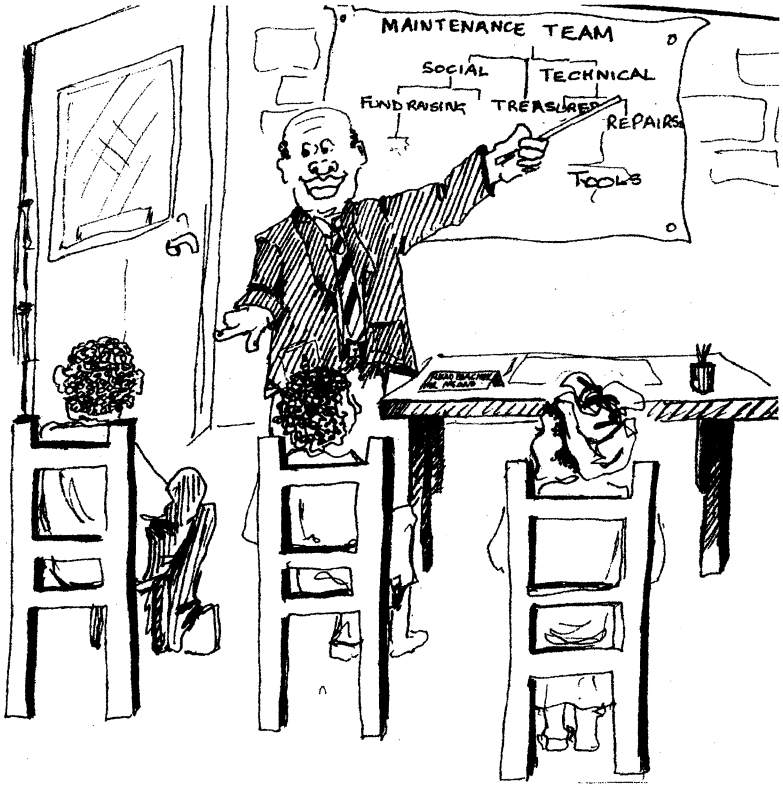
1. **observe** potential problems with the structures
2. **protect** them from misuse and vandalism
3. **keep** them clean
4. **mobilise** funds and other resources
5. **carry** out routine preventive measures

TEAMWORK

It is a good idea if the maintenance committee divides into three main teams or sub-committees

1. **Technical**
2. **Social**
3. **Financial**

Each Team has Action-Oriented Goals. Everyone is **aware** and **responsible** for the tasks of the team.



FOCUS the TEAMS ON ACTION!

- Have **regular** meetings so that everyone on the **Team** is aware of **what is going on.**

- The goal of **maintaining successfully** is what is important, **not** who gets **credit** or **blame.**

- Assign **pairs** to work **together** as a general rule to avoid delays due to the person "responsible" not being available.

POSSIBLE TEAMS AND TASKS

A. Technical Team

TASKS

Monitor Construction
Learn Maintenance Skills
Do Condition-Based Monitoring & Maintenance
Manage Maintenance tools & Materials
Check the Design

B. Social Team

TASKS

Sensitise Community & Enable Decisions
Organise Community meetings
Organise Community Participation

C. Financial Team

TASKS

Assist Fund raising
Manage Funds
Protect Funds
Purchase Materials
Keep Records
Report on the use of Funds

TECHNICAL TEAM

SOCIAL TEAM

FINANCIAL TEAM

ORGANISING THE COMMITTEE

In a football team, the coach, team treasurer and the players work together. The coach directs the team, the treasurer looks after and raises the money and the team scores and defends goal. They get the job done.
Each member has a role to play. They all work together. When one person scores a goal, it is the whole team that benefits.

The maintenance committee works in the same way.

To carry out maintenance you need people who can

- lead it (captain)
- organise people (team coach)
- manage funds (team treasurer)
- inspire the community (team coach)
- supervise and support (mid-field)
- solve problems (defenders)

COMMITTEE MEMBERS

The maintenance committee should include the following members: -

- The Chairman and Deputy Chairman
- The Secretary
- The Treasurer and Deputy Treasurer
- 5 Committee Members preferably with various building or technical skills

Organising **IS NOT** giving people titles.

You must...

a. **Organise** yourselves **for "Action".**

b. Keep meetings **brief** and **focused.**
Organising the committee for maintenance is similar to organising the project committee but the functions are a bit different

c. Meet **regularly** to avoid Crises. Decide on a regular time and place to **meet** as a whole committee. (e.g. every first Saturday of the month)

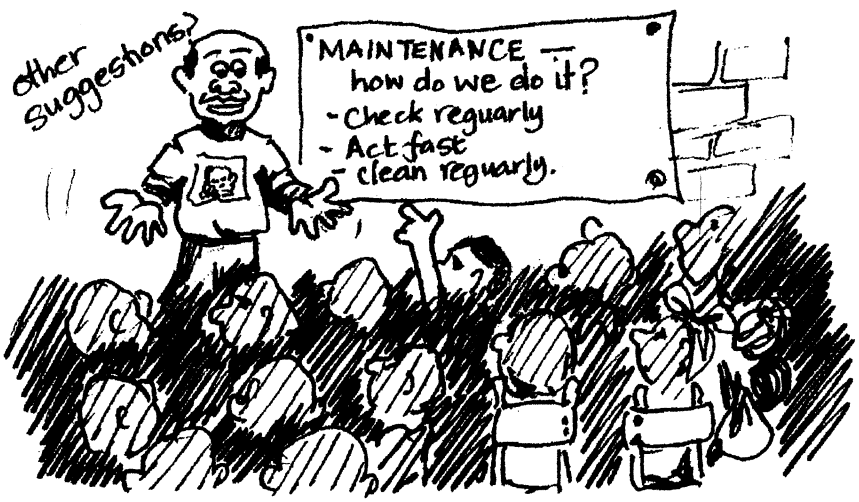
d. Involve members of **the community and their leaders** in the maintenance tasks.

c. Have well-defined **roles** so that everybody knows what they are doing, to avoid confusion.

MAINTENANCE COMMITTEE FUNCTIONS

There are Five major functions of the Maintenance Committee, which, if done well can make the structures last a long time.

1. **Create awareness.**
2. **Organize the community.**
3. **Carry out condition based monitoring.**
4. **Manage funds, resource and tools.**
5. **Build to last.**



Function #1. Create awareness in the community of their responsibility to maintain and to make decisions about how they can do it.

Function #2. Organise the community participation in routine and preventive maintenance activities including everyday maintenance activities, special workdays for maintenance and fund raising activities.

Function #3. Ensure that condition-based monitoring and preventative and routine maintenance activities are carried out regularly.

Function #4. Manage the care and use of funds, resources and maintenance-specific tools. This includes storing, keeping track of, and protecting funds, resources and tools for the express purpose of maintaining.

Function #5. Build to last. Ensure the sustainability of the project before it even begins. The committee must be involved in both the Design and the Construction Stages so that fewer mistakes are made and the building will be easier to maintain.

HOW TO HOLD A COMMITTEE MEETING

a. Opening: Review the Decisions from the last meeting.

b. Reports: Have each team report on

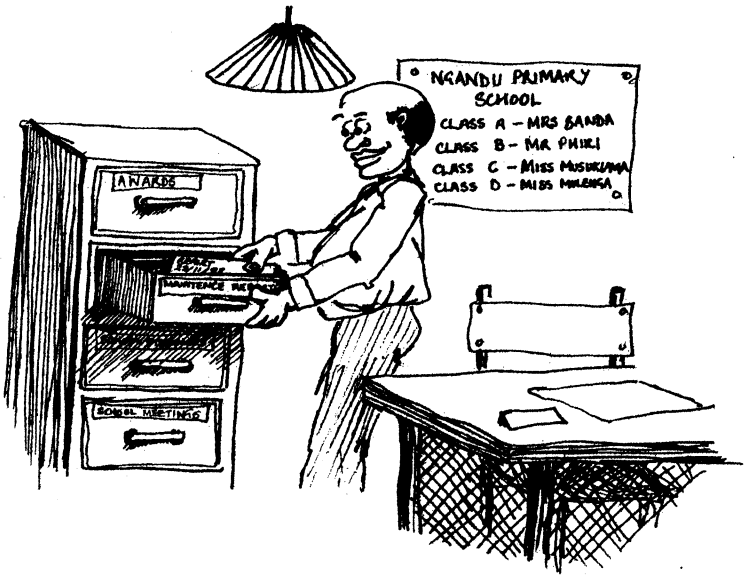
- What they planned to do after the last meeting
- What was done since the last meeting
- Current challenges
- Any Issues needing to be discussed

c. Discussion: Take each issue and discuss:

- The causes of the problem
- Possible Solutions
- Action Plan (What, who, when, how, where)

d. Summary: List and read out the Decisions made at this meeting.

KEEP RECORDS OF ALL MEETINGS



FUNCTION 1

- CREATE COMMUNITY AWARENESS

FUNCTION # 1

CREATE COMMUNITY AWARENESS

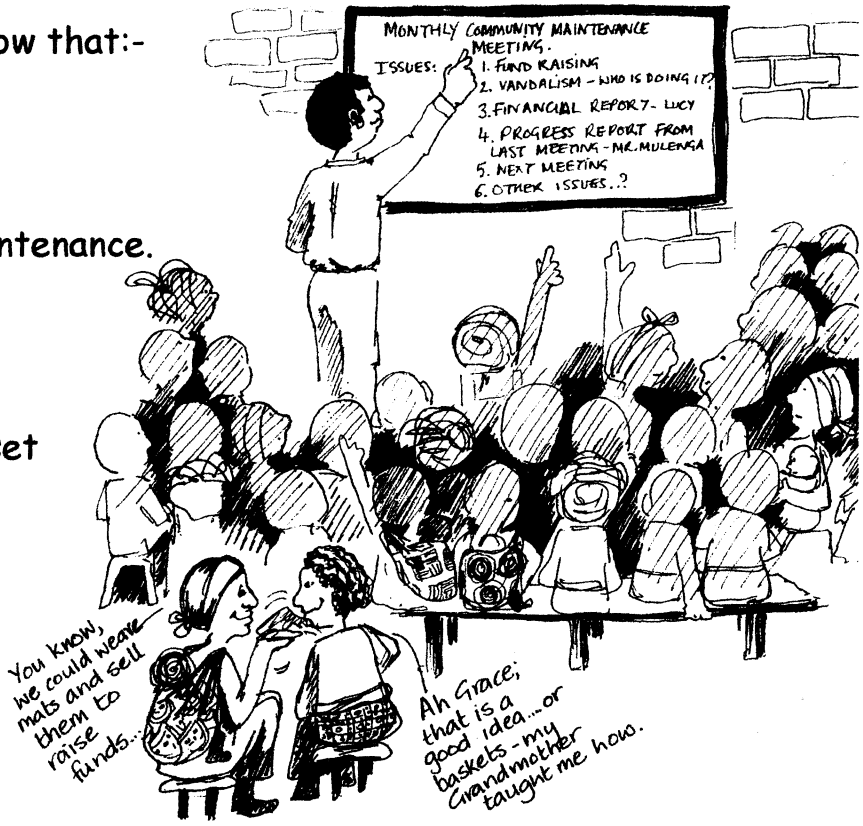
The community members need to know that THEY ARE RESPONSIBLE for their structures. They need to be able to decide HOW they will MAINTAIN.

The community needs to know that:-

These are **our** Structures
We **benefit** from them.
We are **responsible** for maintenance.
We are **capable** of doing it.

And to decide and plan:-
"Rules" to **protect** their asset
How to **raise** funds
Maintenance **schedules**
Security **measures**

The best way to do this is to hold a series of **Community Meetings** which **Create Community Awareness** and **Decisions & Plans are made.**



EXAMPLE OF A COMMUNITY MEETING

The following is an example of a Community Meeting to make people **aware** of their **responsibility** and to create **rules** to protect their structures.

1. Introduction: After the opening and greetings, tell the community that the purpose of the meeting is to ensure that our community structures are being taken care of so that we can use them for many years.

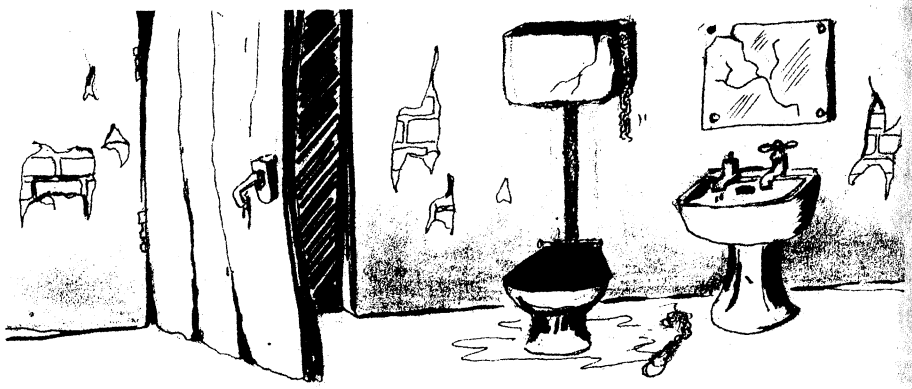
2. Discussion: Hold a brief discussion with the community asking.

- Why are these structures important?
- What would be the impact if they were destroyed?
- What might cause the structure to be destroyed?"
- What can we do to prevent that destruction?

" Say "that is why we are here.... to decide **HOW** to **PREVENT** the **DESTRUCTION** of our structures."

3. **Then discuss WHY must we maintain our buildings?**

- **WE are RESPONSIBLE** to take care of our structures.
- We are benefiting.
- We are in a position to either abuse or take care of our structures.
- No one is going to come and take care of them for us.



- **No one is going to help us build or rehabilitate this again.**
- It is **UP TO US!**

4. **Finally decide HOW we are going to maintain?**

We should decide:-

- What rules we need to protect the structures.
- What routine maintenance activities we need to carry out.
- A monitoring and preventive maintenance schedule.
- What security Measures we need.
- How we collect and look after funds and resources.

FUNCTION 2

- ORGANISING COMMUNITY PARTICIPATION

FUNCTION # 2

ORGANISING COMMUNITY PARTICIPATION

A major role of the Maintenance Committee is to help the Community organise itself to do maintenance.
The Maintenance committee must **involve** and **inform** the **community** in every aspect of maintenance, and not do it all themselves.
The Maintenance Committee must **support the decisions of the community** and ensure community decisions are implemented.

To organise community participation the committee must: -

a. Organise **Special Workdays, Routine Preventive Maintenance activities.**

b. Organise, manage and make available **funds, resources and tools** needed for maintenance activities.

c. **Assist in the monitoring and enforcing** of the **Rules.**

Special Workdays for Maintenance

Sometimes, many people may be needed to do one maintenance task at one time.
For example painting the walls, raising the bore hole pump to fix it, clearing the drains or fixing the road.

The Maintenance Committee can organise a Special Workday

a. Select **"task supervisors"** when a Special Workday is scheduled.

b. Make sure enough of all the necessary **tools and materials** are available on site for the Special Workday.

c. Divide people into **teams** for different tasks.

d. **Equally distribute people** according to the size of the tasks, the time it takes and difficulty.

e. Just before the Workday, **remind** the community again of the date, place, time and tasks.

Agreeing & Enforcing "Rules"

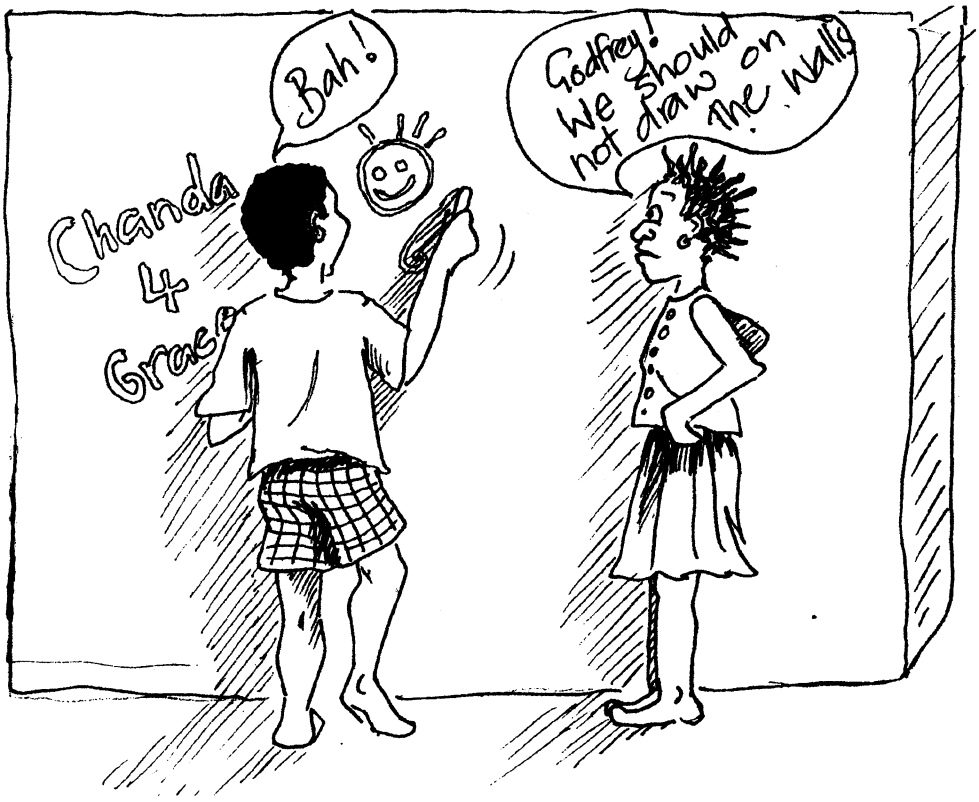
The community must agree what rules they are to put in force to protect their structures.

For example: -

- Do not lean bicycles against the wall; it will damage the plaster.
- Do not throw rocks on the roof, it will crack the sheets.
- Do not hammer nails into the wall.
- Do not slam doors or windows, it will damage the locks and break the glass.
- Do not force taps open and closed, it will damage the washers.
- Do not squat or stand on the toilet pan, it will break.
- Do not throw paper or debris down the toilet, it will become blocked.
- Do not use the toilet if there is no water, it will become blocked.
- Do not force the toilet chain or handle, it will break.
- Do not permit urination on outside walls,
- Keep animals and children away from wells.
- Do not wash pots, clothes or children near the well.
- Punish vandalism severely.
- Do not throw rubbish.

Once the community has decided the rules, the Maintenance Committee needs to assist the community to monitor and ensure that they are being followed.

It is no good having rules if you are not going to follow them.



a. Discuss with the community what **actions** will **damage** the structures and decide what the rules should be.

b. Decide **HOW** the will be **enforced** and **WHO** will enforce them.

c. Decide what will happen if the rules are **broken**.

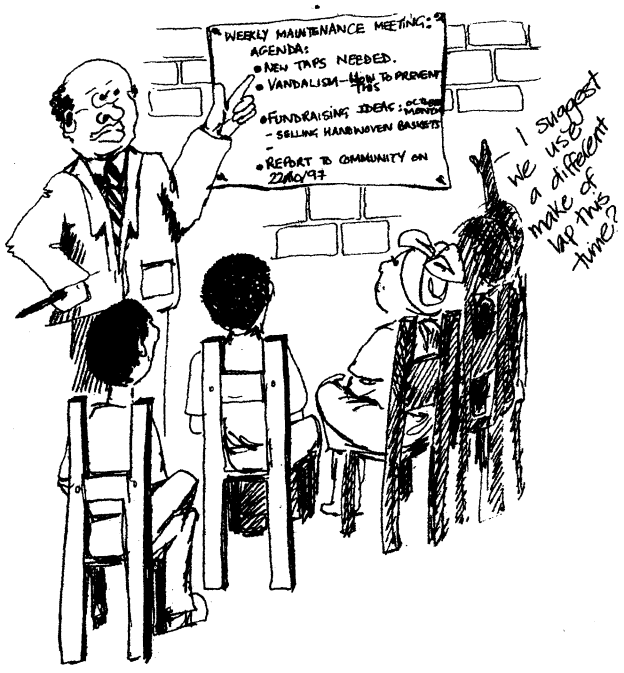
Routine Maintenance Activities

Routine maintenance activities need to be carried out daily, weekly, monthly, yearly, etc.

The maintenance committee should

a. Decide with the **community which activities** need to be done, **why, how** and **when** they should be done.

b. Create a schedule and assign tasks for routine maintenance **with the** people who will be carrying out the tasks.



c. Decide **how the activities will be monitored.**

d. Make sure all necessary **materials and tools are available** for routine maintenance tasks.

e. **Make sure those assigned** to various routine tasks **know how** to do them.

HOW TO CREATE A ROUTINE MAINTENANCE SCHEDULE

STEPS:

1. List the Structures
2. List the Activities
3. Decide whether the tasks should be done daily, weekly, monthly yearly, etc.
4. Decide who will do which activities

For example: -

CLASSROOM 1

Structures	Activities	When	Who
Roof	Clean roof sheets of debris	weekly	Mr Sakala
	Treat timbers	yearly	Grade 4 Boys
	Hammer home loose nails or replace	weekly	Mr Sakala
Doors	Clean	weekly	Grade 4 Girls
	Check hinges and locks & repair	weekly	Grade 4 Boys
	Tighten or replace screws	weekly	Grade 4 Girls
	Oil locks and hinges	monthly	Grade 4 Boys
	Re-paint	yearly	Mr Sakala
Walls	Clean	weekly	Grade 4 Girls
	Re-paint	yearly	Mr Sakala
	Repair plaster	yearly	Mr Makuka
Windows	Clean	weekly	Grade 4 Boys
	Replace broken glass	as necessary	Mr Makuka
	Tighten screws	weekly	Grade 4 Girls
	Re-paint frames	yearly	Grade 4 Boys
Floor	Clean and sweep	daily	Grade 4
	Repair holes or cracks	yearly	Mr Mukuka
	Re-paint	yearly	Mr Sakala

THE WELL

Structures	Activities	When	Who
Windlass	Check the condition and grease	monthly	Mrs Chakota
	Clean and brush with used oil	yearly	Mrs Chanda
Chain	Check the chain and tighten the fixings	weekly	Mr Mbewe
Cover	Check the cover and tighten the fixings	weekly	Mr Mbewe
Bucket	Check the bucket: - replace if missing	weekly	Mrs Chakota
Well	Inspect and remove anything fallen in	daily	Mr. Mbewe
Apron	Clean	daily	Tembo family
	Keep infants and animals away	daily	Tembo family

THE SCHOOL GROUNDS

Structures	Activities	When	Who
Grass	Slash	monthly	Grade 6 boys
	Water	weekly	Grade 6 girls
Trees	Cut back dead branches	Monthly	Mr Sitali
	White wash the bottom of the trunks	yearly	Grade 5
Gates and rails	Sand down and repaint	yearly	Mr Sitali
	Check and oil hinges	monthly	Mr Sitali
Drains	Clean open drains	monthly	Grade 8
	Clear out gullies	monthly	Grade 8
Grounds	Collect rubbish and litter	daily	Everyone
	Burn collected waste	monthly	Mr Sitali

FUNCTION 3

- CONDITION BASED MONITORING

FUNCTION # 3

CONDITION-BASED MONITORING

Another important role of the Maintenance Committee is to **constantly inspect the structures and immediately remedy** any problems that may be emerging. The image might be that of a **"maintenance monitor"** who goes around daily to ensure everything is in working order. When something is found coming loose, or when he sees something is losing its "new" quality, he immediately fixes it, or replaces it, or repaints it, etc. so that it does not become a bigger and more expensive problem.

Sometimes people report problems very well, but NOTHING IS DONE ABOUT IT! **We must ACT!**

The **condition** of each element must be constantly **checked** or **monitored** in order to identify when it is beginning to fail, deteriorate, malfunction or break. The maintenance team can then identify that a **problem** is beginning to arise and determine the **cause**, find a **solution** and effect a **repair**, before it becomes a major issue.

To organise Condition Based Monitoring the maintenance committee must :-

- Assign a **pair of skilled persons** from the Maintenance Committee to oversee this role.
- Create a **List of what to check**
- Monitor the structures **constantly.**
- Create and ensure the availability of **on-going maintenance funds** to be able to take action to deal with issues immediately.

- Create a **practical channel to report** minor damages or wear that needs attention..
- Take **immediate action** to deal with whatever problem or potential problem is found.

FUNCTION 4

- MANAGING MAINTENANCE FUNDS, MATERIALS AND TOOLS

FUNCTION # 4

MANAGING MAINTENANCE FUNDS, MATERIALS AND TOOLS

One of the best ways that the Maintenance Committee can assist the community to take proper care of their structures is to **manage and protect the resources** needed to carry out the maintenance activities.

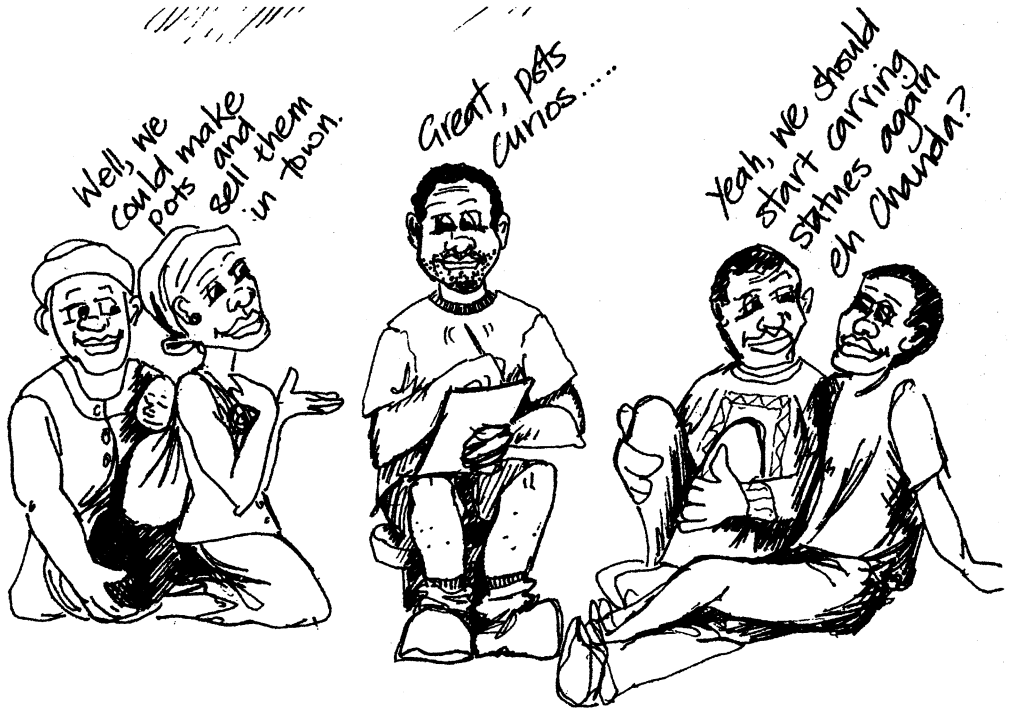
- For maintenance to be successful, funds, materials, labour, local resources and tools must be available.

- Maintenance funds have to be raised, managed and accounted for to the community.

- Tools and materials have to be kept in a secure place.

How to Fund raising for Maintenance

The biggest problem of carrying out maintenance is being able to raise funds.



WE NEED CREATIVE IDEAS

a. It is easier to raise money if you know how much money will be required for maintenance.

b. Plan to **raise the money on a regular basis.**

c. Hold **special "campaigns"** to raise funds for **routine maintenance activities** in good time for when they will be needed.

d. Hold a special community meeting specifically to come up with **"creative ways to generate funds for maintenance".** (Perhaps even have a contest to see who can come up with the most successful ideas).

POSSIBLE FUNDRAISING IDEAS

What are ways to raise funds within our community?
What talents are represented in the community that can be used to raise funds?
What resources do we have as a community that could be utilised to raise funds?

- Solar panels could earn income by charging batteries.
- Collecting cups of maize from the community and selling them.
- Gathering caterpillars and mushrooms and selling them.
- Making and selling baskets, mats, and other crafts and curios.
- Provide entertainment through plays and dance for donations.
- Provide services for the community such as a snack shop.
- Hold sponsored walks or runs.
- Look for sponsorship from companies.

- Create a lima garden and sell fruit and vegetables.
- Hold open or fun days with races, games and performances for an entrance fee.
- Make and sell chairs, tables, doors and windows using the Industrial arts.

Financial Management

a. Create **practical ways** to manage and protect the maintenance funds.

Examples:

- The person who keeps records, receipts, bank statements, and cheques should not have access to the money.

- There should be at least two or three signatures required on a cheque.

- The treasurer should not write any cheque unless there is proper approval for such cheque to be written.

- CASH is easily stolen and people tend to be suspicious of anyone who handles a lot of cash.
  - Try to avoid dealing in cash, use cheques.
  - Try to avoid keeping cash.
  - When it is necessary, keep the amounts small.
  - Keep it in a cash box, with a strong padlock.
  - Never discuss where the cash box is.
  - Let the treasurer keep the key, and let the cash box be kept by the committee members, each member being responsible for a month.
  - Each time the cash box is passed on to a new committee member, the two members should count the cash, agree the amount, write it in the cash book, and sign and date it.

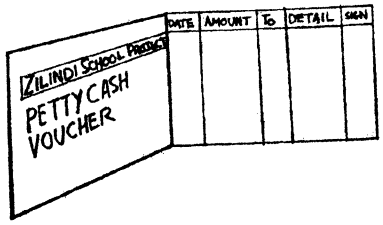
Petty Cash Record

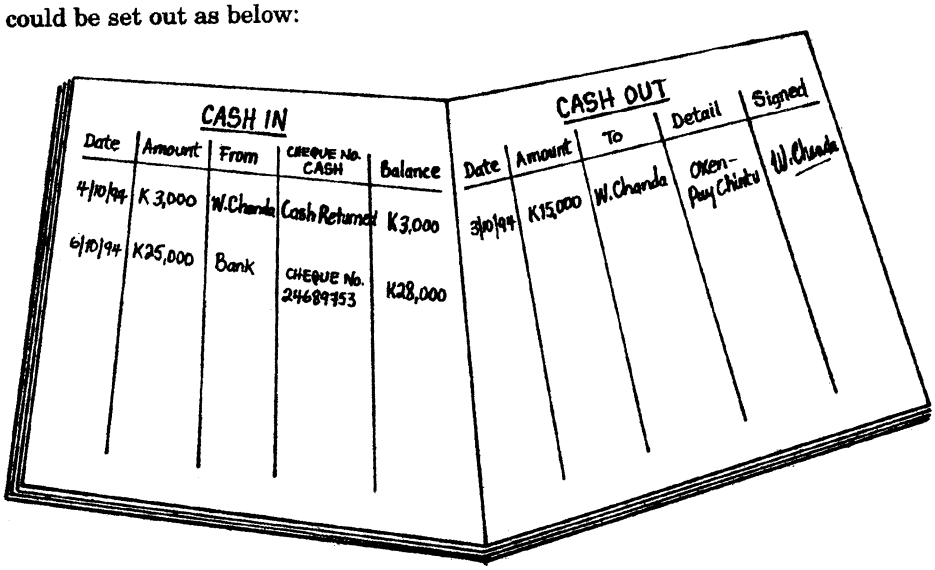
All expenditure is recorded in the Cashbook.

But expenditure is not recorded in the cash book UNTIL there is a receipt.

If a committee member is given cash to pay someone else, the Treasurer should keep a petty cash record of the money until the receipt is brought.

A school notebook would do the job. The pages could be set out as below:





b. Establish a **simple, but thorough record-keeping system**, with records of all transactions, including receipts, signatures when money has gone out before receipts come back in, etc.

c. Establish a simple, but accurate way of preparing a **financial report for the community.**

d. Keep money that has been designated for maintenance in a **separate bank account** from other accounts.

e. Use maintenance funds **solely for the purpose of maintaining the structures.**

f. Create a policy to protect the **Community's** Maintenance funds from abuse by the Maintenance Committee.

Financial Reporting To the Community

When people are unaware of financial matters, they don't feel the need to participate in raising the funds.

Create a **simple financial report form** that will be easy to show and explain to the community at the regular reporting and feedback meetings.
Include:

- Balance in the maintenance account.
- Money received.
- Money spent and how.
- Materials bought.
- Fund raising activities.
- Current problems.

Always begin the current report where the previous report ended, for **continuity** and understanding.

Ask a community person NOT on the Maintenance Committee to assist in the preparation of the financial report.

Keep accurate records to make it easy to prepare reports.

FINANCIAL REPORT

The report should look something like this:

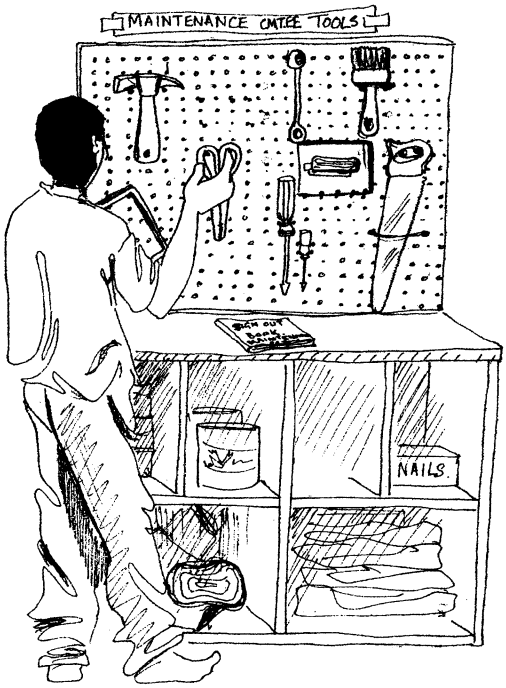
LISULU SCHOOL Financial Report Maintenance May 1998			
Fund raising activities	Money in	Date	Total amount raised
Sales of woven baskets Grace and Lucy Chanda	ZK 61'300 ZK 61'300	23rd May	ZK 102'600
Selling snacks during break Joseph Phiri	ZK 67'500	Weekly	ZK 67'500
		TOTAL	ZK 170'100
Materials purchased	Money out	Date	Total amount spent
2 x taps at 16'000 each	ZK 32'000	21st May	
1 x box screws to fix blackboard	ZK 1'200	26th May	
3 x school chairs at 27'500 each	ZK 110'000	30th May	ZK 143'200
Balance start of May 1998		+ZK 567'329	
Balance end of May 1998. 567'329–170'100+143'200 +ZK 594'229			
Other issues/current problems Painting needs doing next month			

How to Keep Tools, Stores & Inventory

Often, when tools are needed for maintenance activities, they are not available.

- **Nominate one person to be the Store man**

- **Create an inventory and record-keeping system** to keep track of tools and materials. The store man must always know:-
  - What comes IN?
  - What goes OUT?
  - Who it goes out to?
  - Why it is out?
  - What remains in the store?
  - What needs buying?
  - What tools there are?
  - What tools are being used and by who?
  - What tools are returned or kept by someone?



- Store tools and materials properly so that they do not become damaged.
  - Small tools should be stored on hooks or nails on a large wooden board.
  - Restrict access to one or two people, this makes it easy to be sure where the tools are, reduce the risk of and identify losses.
  - Keep quantities of the same type of materials together so that they are easy to count and check.

- Do not lend maintenance tools or materials out for any other uses.

But it may be a good idea to **HIRE** tools out to make money for the maintenance funds.

- The Store man should keep the **tools in working order.**
  - Clean the tools after use.
  - Keep wheel barrow wheels greased and tools lightly oiled.
  - Sharpen spades, picks, slashers and pangas.

- Provide **secure and adequate space** for tools and materials.
  - Provide a separate room or tool shed.
  - Fit a strong grill and door with a heavy padlock.
  - If there is a watchman, make sure he checks the store regularly.

- The Store man should make sure that tools **come back in good working order** after maintenance activities.

- The Store man **should provide records and give reports** both to the Maintenance Committee regularly, as well as to the community periodically.

STORES DELIVERY

DATE	RECEIPT No.	SUPPLIER	MATERIAL	UNIT MEASURE	QUANTITY
11-9-94	4238	Bagn Stores	Cement	Pocket	120
11-9-94	4238	Bagn Stores	Conforce 236	Roll	2
15-9-94	9410	Habriaa Co.	Glass	Cut panes	72
4-10-94	6321	Mulenga	Putty	Kg	20
4-10-94	3110	Patel	Gloss Paint Blue	5 Litre	5

- The Store man should **alert** the other Maintenance Committee members when there is **need to replace tools or materials in good time.**

FUNCTION 5

- BUILD TO LAST

FUNCTION # 5

BUILD TO LAST

Often communities are involved in building their own structures. They are lucky because they can make their maintenance job easier.

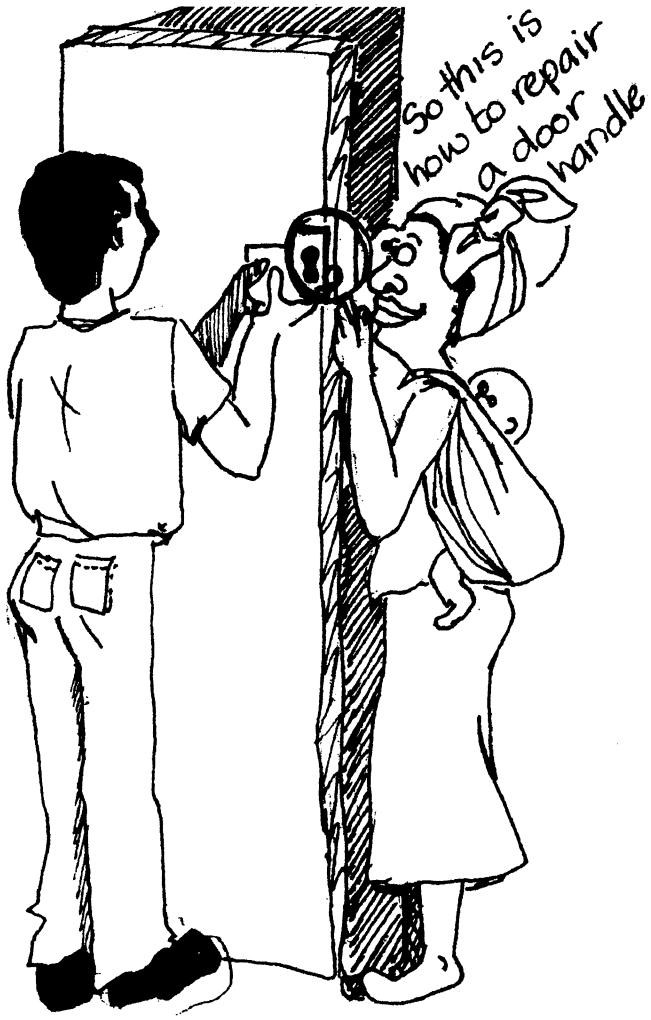
Let's not make it difficult for ourselves to take care of our structures!

When a new structure is being constructed, the maintenance committee must be sure that all unnecessary defects and future problems are avoided. This will help save money spent on maintenance later.

1. The maintenance committee must ensure that the design of the structure is appropriate, nothing is missing and it is simple enough for the community to look after.

2. The maintenance committee **MONITORS** the construction and ensures that the materials used are good quality and will last a long time.

3. The maintenance committee must **LEARN** everything it can about the structure and how it is built. This will help you to know how you can keep it in good condition after construction is completed, and what skills are necessary and where these might be available.



What to Check during the Design Stage

We should have checked the design more carefully and we wouldn't have this problem now!

We only create problems for ourselves when we use cheap fittings and materials.

- Is the design suitable for your needs, and is it what was agreed with the community?
- Are you able to maintain the structures?
- Will it be easy to maintain?
- Check the materials specified, such as blocks, roof sheets, glass, paint, and so on, are good quality. and strong enough for the job.
- Check that the fittings, such as mortise locks, door handles, window stays, toilet cisterns and so on, are good quality and strong enough.
- Be involved in the purchasing decisions so that good quality and durable materials are being used for the construction – if cheap and poor materials are used they will not last and will create maintenance problems later on.
- Has any thing relevant to your needs been missed :- access, drainage, sanitation, power, water, and so on.

Monitor the Construction of Projects to Ensure Quality

- **Observe and Monitor** workmanship - if it is poor this will create maintenance problems later on.

- **Check** that the plans are followed and that nothing is left out.

- **Ask** the Technical Supervisor about issues you do not understand or see as a problem.

- **Discuss any problems** with the Project Committee and District Technical Officer and try to resolve them together.

- Be present and **involved in the Monitoring visits** of the District Technical Officer. Join in with any **on-the-job** training such as :- Financial management, stores keeping, technical and construction workshops, and so on.

CHAPTER 3
MAINTENANCE OF BUILDINGS

- INTRODUCTION
- GENERAL MAINTENANCE AND RULES
- FOUNDATIONS
- EXTERNAL
- FLOORS
- WALLS
- CEILINGS
- ROOFS
- WINDOWS AND DOORS
- WATER SUPPLY AND PLUMBING
- FOUL SEWERAGE
- ELECTRICAL
- FIXTURES
- ROADS
- TOOLS

CHAPTER 3 MAINTENANCE OF BUILDINGS

INTRODUCTION

The first step in maintenance is to recognise where and when maintenance is required. In order to achieve this the maintenance team must have a clear understanding of the purpose of each element that makes up the structure and how it works.

For example;

A toilet cistern has an inlet that supplies water to the holding tank. A floating ball valve stops water flowing when the tank is full, and allows water to flow when it is empty.

The floating ball fixed to a lever, opens and closes the valve.

When the system fails, with the understanding of how it works, it should be simple to fix it.
The ball may not be raising the lever enough because the lever is broken or loose, or the ball has cracked and filled with water.

The lever or the ball may be fixed or replaced as necessary. Simple if the technical knowledge is available.

This chapter lists the most common defects for each element of a structure and discusses the problem, cause and solution for each defect. It is by no means fully comprehensive but should provide you with a useful guide to the technical aspects of maintenance.

GENERAL MAINTENANCE AND RULES

CLEANLINESS

- Wash and sweep the floors daily.
- Wash dirty marks off the walls daily.
- Clean the windows weekly.
- Do not allow people to lean against the walls.
- Do not allow writing on the walls.
- Collect and remove all debris and litter daily.
- Burn all flammable rubbish in the incinerator, and dispose of the rest in the rubbish pit.
- Clean out the drains, gullies and ditches monthly.
- Slash the grass weekly.
- Clean off all termite soil tunnels as soon as they appear on the building.
- Keep furniture away from the walls or fit bump rails.
- Sweep debris off the roof monthly, and do not allow crops to be stored or dried on the roof.
- Mop the toilets and pit latrines clean daily and disinfect weekly.
- Clean the sinks and basins daily.

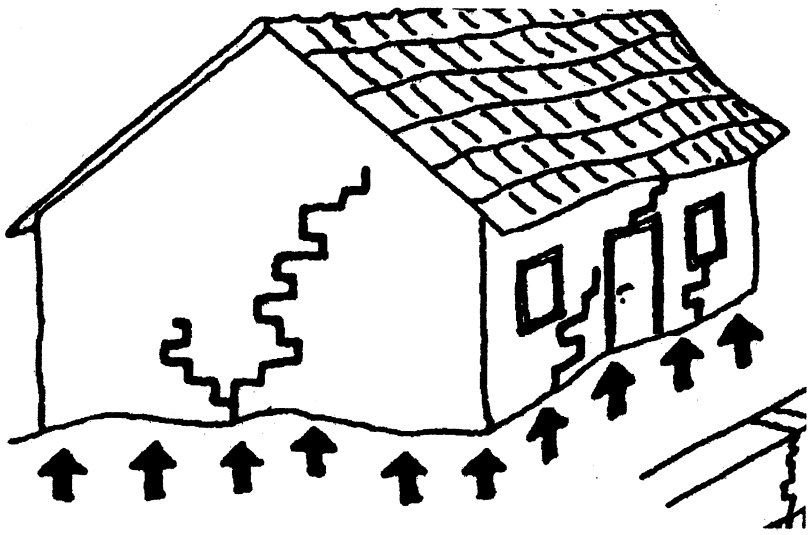
CARE AND CONSIDERATION

- Do not lean objects, such as bicycles against the wall, it will damage the plaster.
- Do not throw stones or other objects on the roof, it will crack the sheets.
- Do not hammer nails into the wall, fit a timber-hanging rail.
- Do not slam doors or windows, it will damage the locks and break the glass.
- Do not force taps open and closed, this will damage the washers.
- Do not squat or stand on the toilet pan, it will break.
- Do not throw paper or debris down the toilet, it will become blocked.
- Do not use the toilet if there is no water, it will become blocked.
- Do not force the toilet chain or handle, it will break.
- Do not permit urination on outside walls,
- Keep animals and children away from wells.
- Do not wash pots, clothes or children near the well, provide special washing areas.
- Punish vandalism severely.
- Do not throw rubbish.

FOUNDATIONS

SUBSIDENCE

Problem: Severe cracks in the walls, diagonal or vertical, and large at the top, tapering down to hairline at the bottom.

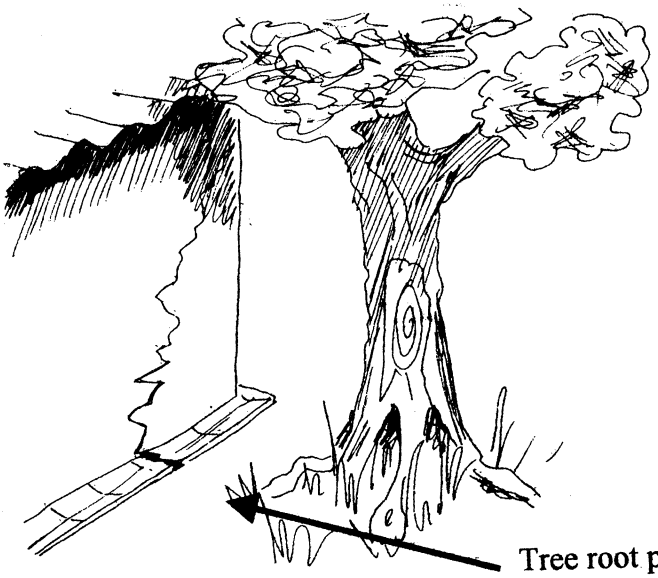


Cause: Movement in the foundations caused by settlement or subsidence of the soil and or inadequate foundations for the type of soil. This is often worsened by poor drainage around the building for surface rainwater run off.

Solution: You should seek advice from a technical expert to find out the cause of the subsidence and to provide a solution.

If the cause is due to the foundations subsiding, the foundations must be strengthened. This is usually done by `underpinning` the foundations, by excavating under the foundations down to stronger ground and pouring mass concrete underneath the existing foundation to stabilise the building. It is specialised work and should be carried out by an experienced contractor, supervised by a technical expert.

TREES AND ROOTS



Tree root pushing under the building

Problem: Cracks running along the floor slab and often continuing up nearby walls and damaged sewer pipes

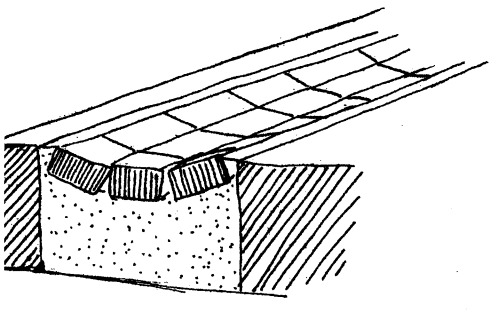
Cause: Large tree roots growing under the building and pushing sewer pipes aside.

Solution: The roots should be located by digging a trench 1.5m deep between the building and the tree, and the roots cut back, or if it is possible the tree should be cut down. Avoid planting trees near buildings.

DRAINAGE

Problem: Water collecting around the building that will soften the soil and cause the risk of subsidence.

Cause: Poor drainage for surface water run off.



Solution: The drainage can be improved by constructing a three brick dish drain around the building to take the rain water away from the building to a soak-away. The soak-away should be located on the lowest side of the building at least 10 metres away.

Do not make a screed over the brick dish drain as this will crack, slow down the water run off and make the drain ineffective.

EXTERNAL

STORM WATER DRAINAGE

Problem: External areas flooding.

Cause: Storm water drainage blocked or too small.

Solution: Maintain the drains free of mud, debris and grass, especially just before the rainy season. Check all gullies and keep them free of leaves and rubbish. If the drains are too small then increase the size of the drains. Always use open drains, they are easier to maintain.

GUTTERS AND DOWNPIPES

Problem: Leaking or overflowing gutters, damaged or broken gutters and down pipes.

Cause: The gutters and down pipes often become blocked due to leaves and rubbish collecting on the roof and being washed into the gutter.
Gutters and down pipes often become loose or damaged due to the fixings becoming loose, either because of age or the quality of the fixings.

Solution: Keep the gutters and roof free of leaves and rubbish, especially just before the rainy season.
Check the gutter and down pipe fixing screws and replace any bad ones. Use large wood screws to fix to a fascia, and `plug` screws fixed into plastic plugs driven into drilled holes to fix to a wall.
Check the gutter and down pipe joints for leakage. Where leaks are found, they must be repaired as described in the section on gutters and valley linings.

GRASS AND TREES

Problem: Untidy surroundings, erosion, falling branches and leaves, and the possibility of snakes.
Lack of shade, no trees.

Cause: Long unkempt grass areas make your surroundings look untidy and will attract snakes.
Tall nearby trees will shed leaves and sometimes branches that may fall onto roofs causing damage and blocking the gutters or drains.
Where there is no grass around buildings, rain water run off will erode the soil causing ruts and pot holes, and in bad cases often combined with sweeping, may expose the foundations which will weaken them.

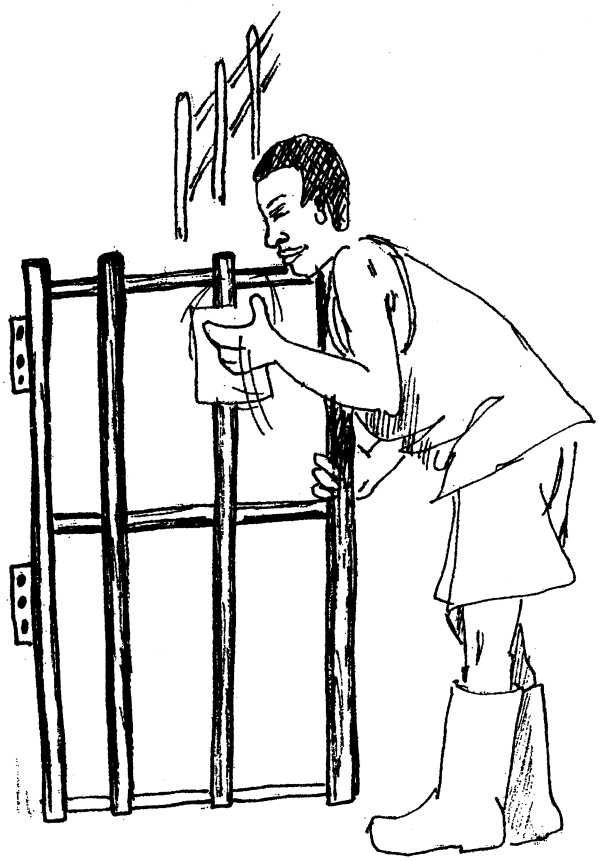
Trees are often cut down for firewood or building but they are not replaced.

Solution: Slash the grass regularly to keep it short and tidy and cut back long and dead branches from the trees.
Plant extra grass and flowers around buildings to help keep the soil from eroding. This will also be attractive.
Trees should be planted to replace any that die or are chopped down.
Make sure that the trees are planted at least 20 metres away from any structure or pipe line.

GATES

Problem: Hinges and latches broken, rusty or peeling paint.

Cause: Age, and wear and tear.



Solution: When the gate appears to sag and will not close well, check the hinges and latches, and repair or replace them as required. Welding may be needed, so contract a good welder as poor welding will make the problem worse not better. Sand down the steel thoroughly and paint with good quality, red oxide primer and two coats of good quality gloss paint.
Keep the hinges greased.

REFUSE COLLECTION AND DISPOSAL

Problem: Rubbish and litter on the ground, dirty surroundings.

Cause: Poor refuse collection and disposal.

Solution: Provide large empty open drums for litter and rubbish to be put in at suitable places around the area. Make sure that the drums are emptied at regular times, say once a week.
The waste should be taken to the local council tip, or to a large open pit located safely away from your buildings. These pits must be

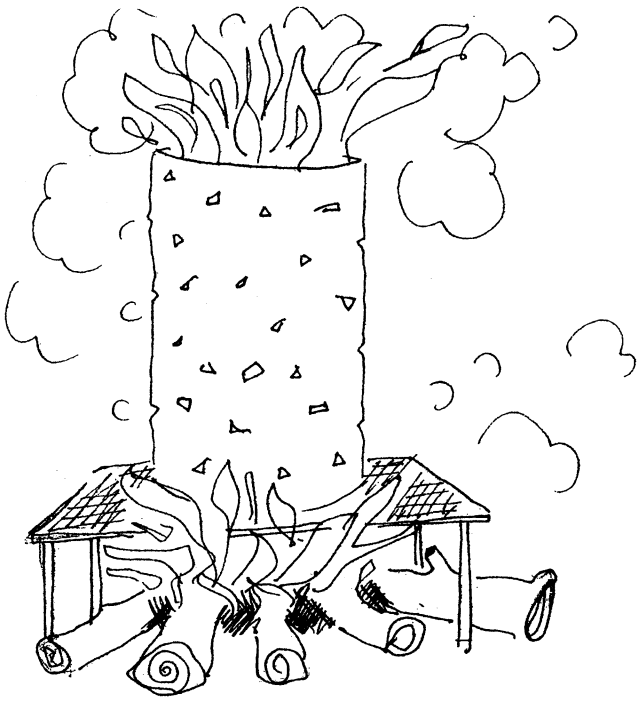
marked ` OUT OF BOUNDS` and preferably fenced off behind a hedge or wire fence. Check with your local council if a special licence is required for dumping.

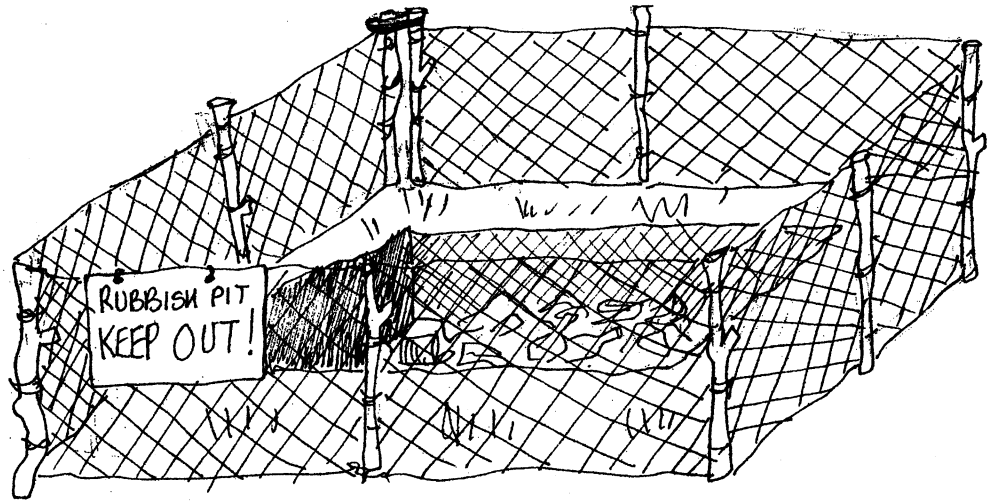
Make a simple incinerator to dispose of all combustible waste, burn every thing you can.

Take an old 200 litre drum and punch holes in the sides and base. Place it on top of a steel frame or dwarf block wall in a well-ventilated clear area.

Place all paper, cardboard, plastic bags and bottles, and any other waste that will burn in the drum to half fill it. Set the waste on fire and then continue to feed in all flammable waste keeping the flames high.

After burning the waste, clean out the ashes and put them in the pit.

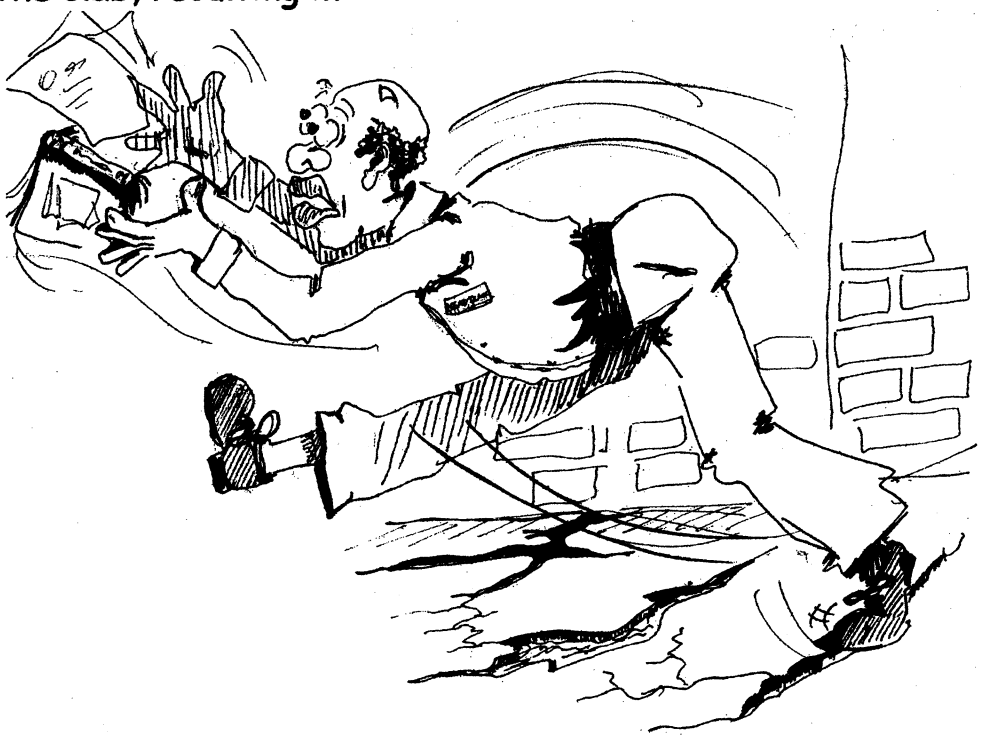




FLOORS

SCREED

Problem: With time the screed cracks and de-bonds from the slab, resulting in the screed breaking up with numerous hair line cracks or becoming pot holed.



Cause: Poor concrete mixes resulting in low strength, and poor preparation of the slab before laying the screed and inadequate curing can result in early failure of the screed.

Solution: By lightly tapping the surface with a hammer, it is easy to find the areas that have de-bonded. Listen for the hollow sound and mark the areas clearly. Hack out all areas of worn or loose de-bonded screed until there are only good strong undamaged areas left.

Carefully prepare the surface of the exposed concrete slab by using a hammer and chisel until the whole area is roughened and you can clearly see the stones in the concrete surface.
Wash the areas with clean water and a wire brush to remove all chips of concrete and dust.

Mix wet cement slurry of 1:1 cement: river sand mix and brush this onto the prepared surface. Before this dries, mix the screed 1:3 cement: sand.
Always use washed clean river sand.

Pack the screed onto the slab using a heavy steel tamp (dindo). A timber tamp is not good enough to compact the screed well. Then wood float, applying as much pressure as possible, and finish the floor with a steel float as the screed dries.

HINT Do Not throw cement onto the screed as you finish, this will cause fine crazing and dusting on the surface and does not make the screed strong.

Finally, after about 3 hours when the cement has hardened, spray water over the new screed and cover it with a plastic sheet. Keep this up for three days, making sure that the screed is always damp. This is called " curing".

Then repaint the floor using two coats of good quality floor paint. Allow the paint to dry for 3 days and then polish the floor with a good floor polish. Polishing should be kept up as a routine weekly job to protect the floor.

P.V.C. TILES

Problem: P.V.C. floor tiles become brittle and crack. Often tiles become loose and the corners lift and break off.

Cause: Old tiles will eventually wear out through use and will have to be replaced. P.V.C. tiles should not be cleaned using excessive water as the water seeps under the tile and causes the glue to fail, the tile then lifts up and eventually becomes loose. The use of a damp cloth and then constant polishing with a good floor wax is recommended.

Solution: Cracked, damaged or loose tiles should be removed carefully, and the screed below cleaned thoroughly to remove all the old glue. The exposed screed should be lightly roughened using sandpaper and cleaned using a damp cloth. Leave the surface to dry out completely before replacing the tiles.

If the screed below is damaged, this must be repaired first (refer to the section on screeds).

Use a tile adhesive applied with a plastic spatula, following the tile adhesive instructions carefully. Fix the tiles in place and firmly tap them into position using a block of wood and hammer. Clean away excess glue along the joints and leave the repaired floor for at least three days before allowing it to be used.

Polishing should be kept up as a routine weekly job to protect the floor. This protects the tiles well and will extend the life of the floor.

SOLID CONCRETE FLOOR

Problem: Small cracks and potholes.

Cause: Small hairline cracks appear due to shrinkage of the concrete with the seasons. Holes are due to small areas of weaker concrete which eventually open up and get worse.

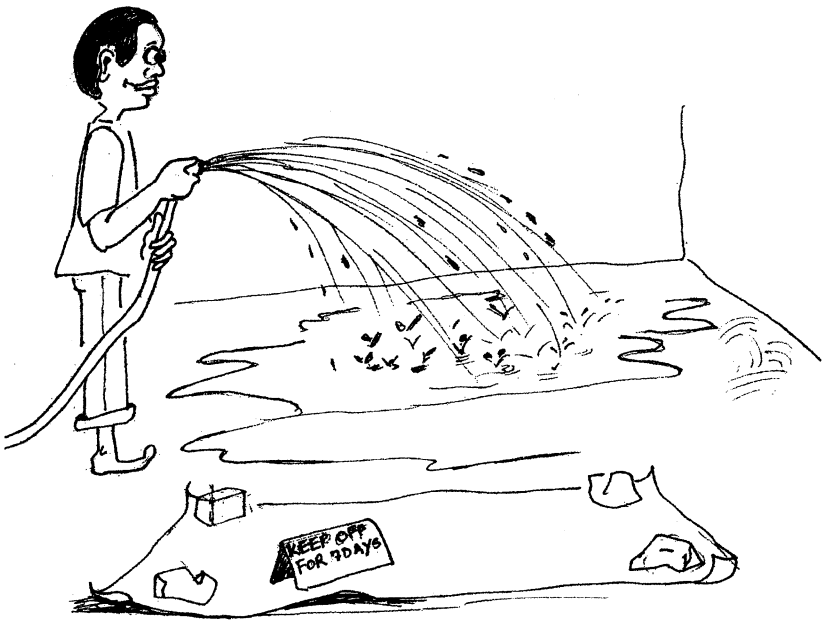
Solution: Hack out the area around the damaged concrete into solid undamaged concrete. Always hack out a little more than you think necessary.

Wash the areas with clean water to remove all chips of concrete and dust. Mix a wet cement slurry of 1:1 cement: river sand mix and brush this onto the prepared surface. Mix concrete 1:1:2 cement: sand: stone. Use washed, clean sand and stone. The stone should be 10mm maximum size.

Steel float the concrete applying as much pressure as possible. Do Not throw cement onto the concrete as you finish, this will cause

fine crazing and dusting on the surface and does not make the concrete strong.

Finally after about 5 hours, or as soon as the surface is strong enough to walk on, spray water over the repaired patch and cover it with a plastic sheet (This is called curing). Keep this up for three days, making sure that the repair is always damp.



After the repair is complete, clean and sand down the floor, wash away the dust and wait seven days for the concrete to dry out completely.

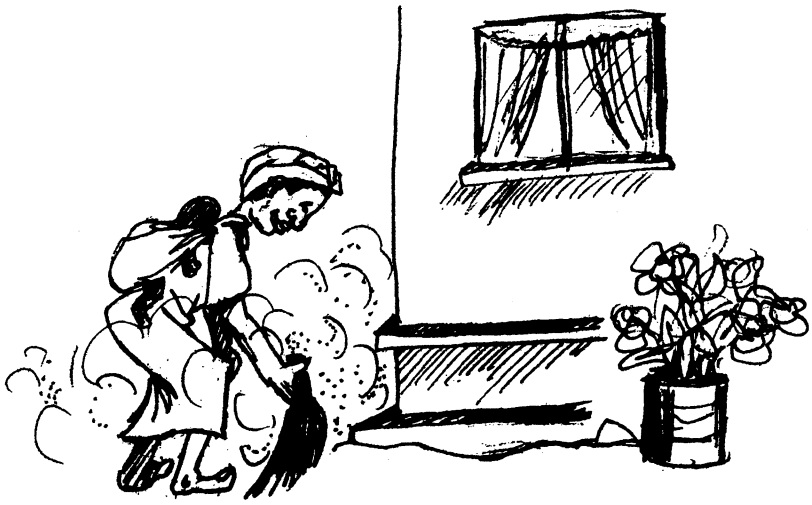
Then repaint the floor using two coats of good quality floor paint. Allow the paint to dry for 3 days and then polish the floor with a good floor polish. Polishing should be kept up as a routine weekly job to protect the floor.

WALLS

FOUNDATION WALLS

Problem: Moisture penetration, erosion, plaster cracks.

Cause: Poor drainage and erosion around buildings allows the natural ground level to be washed away, exposing the foundation walls below the protective external plaster and lets moisture into the walls. This is often made worse by constant sweeping around the building that in time reduces the ground levels, in some cases down to the foundation concrete. The damp causes the plaster to de-bond and crack.



Solution: Damaged plaster should be hacked out, the bricks or blocks cleaned and the mortar joints` raked or roughened to form a key for new plaster.
Apply 20mm thick 1:3 cement sand and finish with a wood float finish. Form a rounded joint between the foundation wall plaster and the bottom of the floor slab. This will stop moisture rising up into the walls by separating the plaster above and below the slab.

A bituminous paint should then be applied to protect the plaster from rain and ground water. Wait 14 days for the plaster to dry and then paint on three coats of bituminous paint, each new coat applied when the previous coat is touch dry.

The soil that protects the foundations must then be replaced. The first layers should be laterite, with a final layer of topsoil if grass is to be planted, or cement stabilised laterite for a hardwearing soil surface.

The laterite should be carefully spread out in layers of 150mm and no more, to allow good compacting. Then moisten the laterite and compact it with a heavy steel `dindo` or tamp. These can be made up using a piece of steel channel welded to a length of water pipe, or a 5 litre paint pot filled with concrete with a pipe cast in as a handle. After compacting, water the area and place the next layer of laterite on top, until the soil is approximately 300mm from the top of the floor slab.

The last layer can be made more durable by mixing 1: 6 cement: dry laterite. When the laterite is watered and finally compacted the cement will harden this layer.

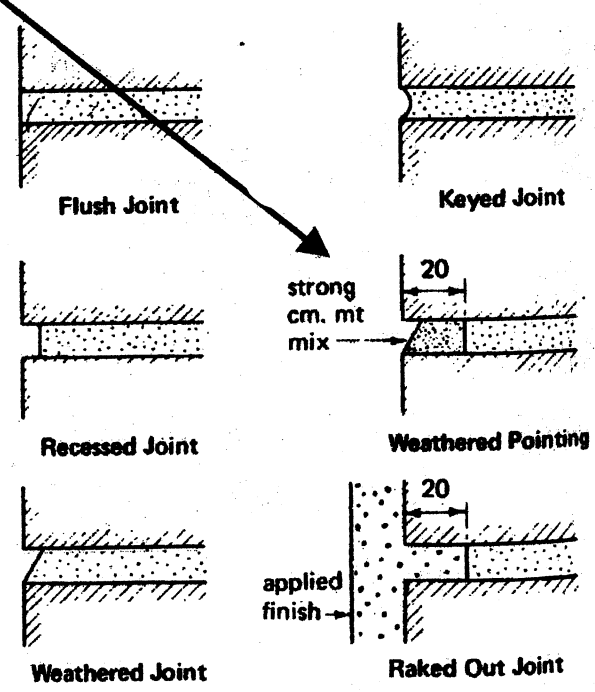
FACE BRICK & BLOCK WALLS

Problem: Weak and crumbling mortar joints, combined with moisture penetration, damp internal plaster and in some cases peeling paint.

Cause: In time, after years of being exposed to wind and rain, the mortar joints between the blocks become weak and begin to wear away or spall. The mortar is washed out and the joints become deeper, allowing water to cling to and seep into the wall, which in turn will damage the internal plaster and paint.

Solution: The mortar joints must be repaired and protected. Rake out the damaged joints until strong mortar is found, to a minimum depth of 20mm. Then re-point the joints with 1:4 cement: sand mortar and finish with a **Weathered Joint**, formed by drawing the point of the trowel at a slight angle along the course. This encourages the rainwater to flow quickly down and off the wall.

To further protect the face brick or block apply good quality external wall gloss paint or apply bag wash. Bag wash is cement slurry paint, made using cement mixed with water 1Kg cement to 10 litres of water. Some times good quality red face bricks are used, these should be protected using a clear external quality varnish instead.

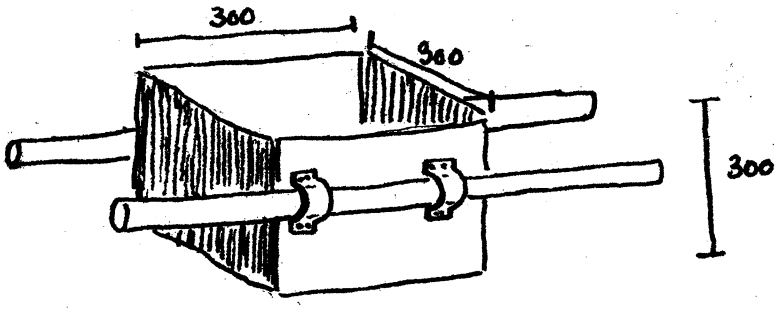


There are many good quality paints now available in Zambia. Look out for known trade names such as Dulux or paints approved by the Zambian Bureau of Standards. Always read the manufacturers instructions on how to use the paint and prepare the surfaces carefully and follow them.

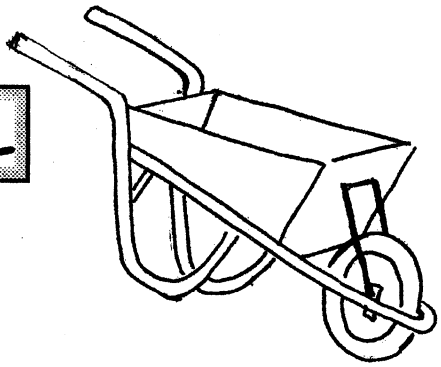
PLASTERED WALLS

Problem: Hairline crazing or plaster spalling.

Cause: -The plaster used in construction in recent times tends to be cement: sand plaster that should be mixed 1:3 using sieved washed well graded fine sand. The mix is critical and if this is not correct the plaster will be weak and tend to crack and spall. The cement and sand must be measured accurately in gauge boxes usually 300mm x 300mm x 300mm.



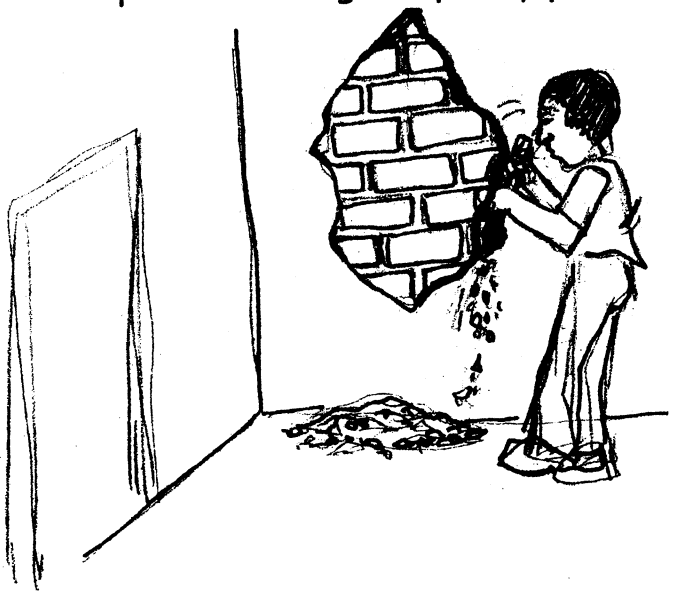
DOES NOT EQUAL



ONE BAG OF CEMENT **ONE WHEEL BARROW**

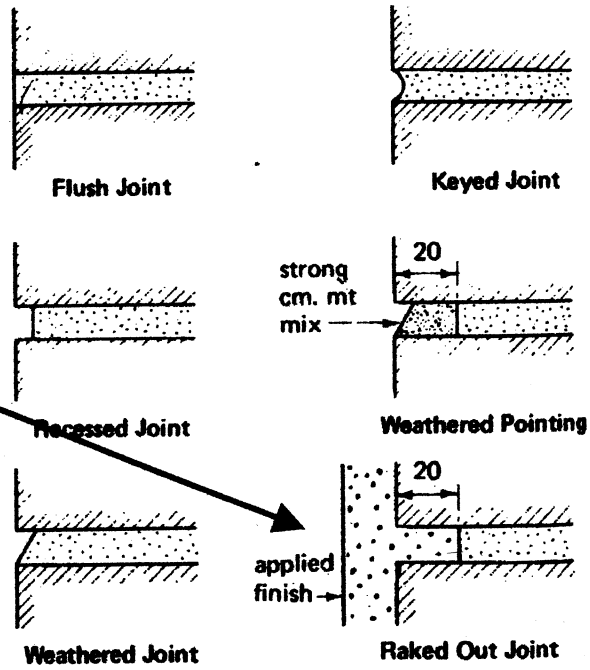
REMEMBER, Do not measure using wheelbarrows, unless the barrow has been carefully measured and marked to show the level a pocket of cement fills, and then measuring the sand to the same mark. Remember one pocket of cement does not equal one wheelbarrow of sand. Using a full wheelbarrow as a measure will cause the plaster mix to be weak, (about 1:6), and this will lead to hairline cracking and spalling of the finished plaster.

Solution: Areas that show signs of minor hair line crazing should be sanded down, and the cracks filled using a good quality crack filler, and then painted with good quality paint.



Areas with severe hair line cracks, spalling or crumbling plaster or loose hollow sounding (when tapped with a big screwdriver handle) plaster should be hacked out and re-plastered.

Once the plaster has been hacked out, all exposed mortar joints should be raked out to a depth of 20mm to form a good key for the new plaster to adhere or catch well. This is called a **Raked Out Joint**. Prepare the plaster carefully measuring using a batch box, mix 1:3. Before applying the plaster, the blocks should be lightly dampened using a sponge to stop water being taken out of the mix and into the porous blocks. Trowel the plaster onto the wall, strike off using o timber rule or straight edge and finish with a wood float first. This is called the floating coat. Just before the plaster sets finish off with a setting coat of 4-5 mm using either a steel or wooden float. Leave the wall to dry out completely, 7 days minimum and then paint with **good quality** paint.



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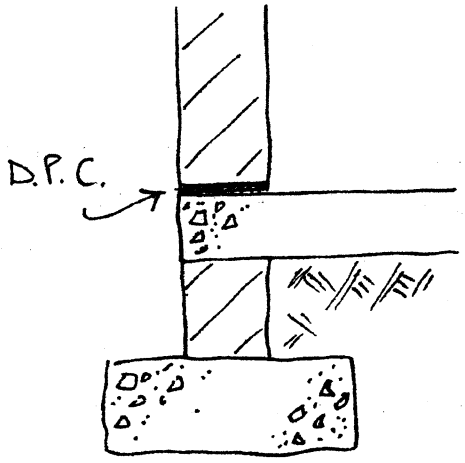
Always read the manufacturers instructions on how to use the paint and prepare the surfaces carefully and follow them.

DAMP PROOF COURSE

Problem: Walls are liable to become damp in the rainy season by dampness rising up the walls from the ground. This is undesirable and will damage the plaster and paint.

Cause: Inadequate or no Damp Proof Course (DPC) will allow moisture to be absorbed into the plaster and blocks from the ground by capillary action. The moisture climbs the wall by being drawn into the pores of the blocks, just like a sponge or cloth sucks up water.

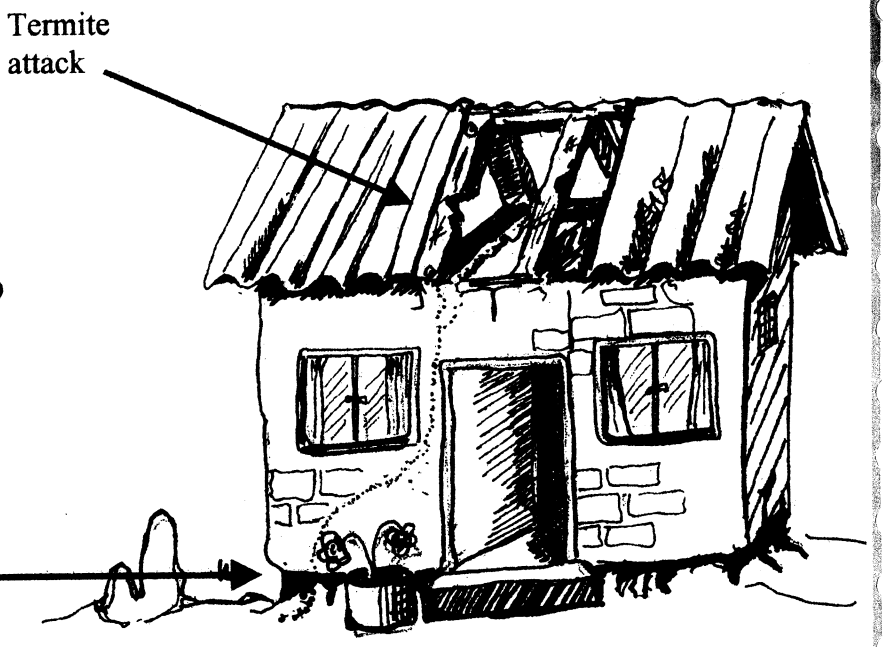


Solution: A 3 ply felt Damp Proof Course (DPC) should have been used in construction.
Check that the DPC is at least 150mm above ground level. If it is not dig the ground level down around the building until it is.
Check that the DPC is not plastered over. If it is, form a wide v-joint at the DPC to ensure that no plaster covers it. This will stop moisture climbing up the wall in the plaster.

If there is no DPC, one should be installed in sections all around the outside walls. This however is a specialist job and a contractor should be engaged to carry out the work.

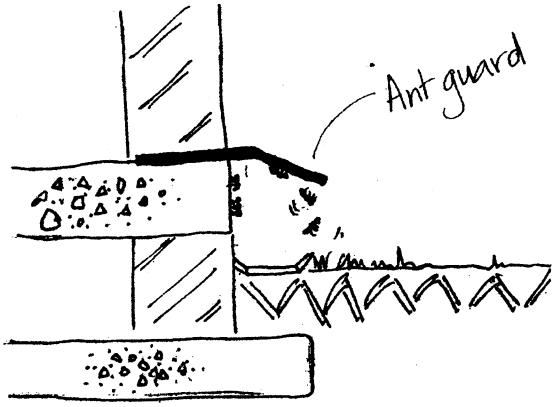
REMEMBER:- Consult your District Buildings Officer for advice.

ANT GUARD



Problem: Ants and termites climbing up the walls and into the roof timbers. This can cause major damage to the building and materials in the building.

Cause: Ants and termites will get into the building by climbing up the outside of the walls if there is no ant guard installed. The ant guard is either a protrusion of the floor slab about 100mm from the face of the wall externally, or a galvanised iron sheet placed between the foundation wall and the floor slab protruding from the wall about 100mm and with the end turned down slightly. Ants and termites do not like to walk upside down and will turn back when faced with this guard.



Solution: If there is an ant guard, check all around the building to make sure that the ant guard has not been damaged or pushed down to touch the ground or wall, allowing a way on to the wall or past the guard. They only need one way in. Repair the ant guard as necessary, floor slab guards should be reformed with plaster, and iron ant guards should be carefully bent into shape and joins should be soldered tightly together.

If there is no ant guard, one should be installed in sections all around the outside walls. This however is a specialist job and a contractor should be engaged to carry out the work.

To further prevent ants and termites, ant poison can be sprayed onto the ground around the outside of the building.

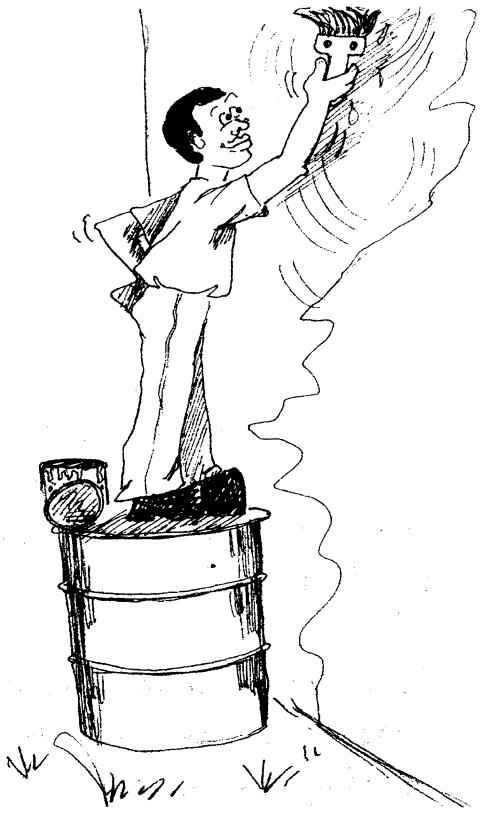
Poison is available in building hardware shops, and care should be taken in handling the poison.

Keep the treated area out of bounds until the poison has been completely absorbed into the soil.

PAINTING

Problem: Dirty, Peeling, blistering or flaking.

Cause: Wear and tear, loss of adhesion because of moisture in the wall and plaster, mild chemical attack by lime in the cement due to painting before the plaster is completely dried, poor preparation of the walls before painting, and poor quality paint.



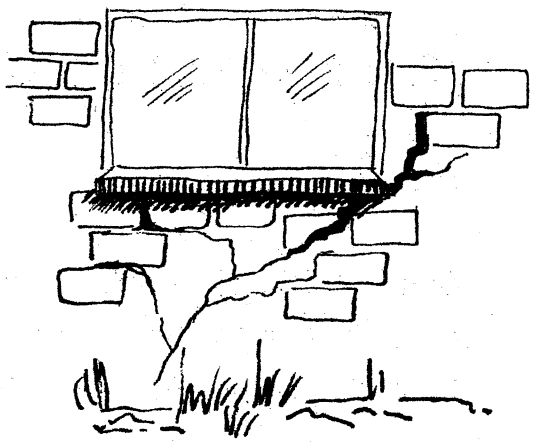
Solution: For moisture in the wall, first you must remedy the cause. Refer to the section on damp proof course.
Strip the paint completely back to the plaster, ensure that the area is completely dried out, and repaint as follows.
First apply one coat of good quality undercoat, followed by a minimum of three coats of good quality gloss or PVA paint as required.

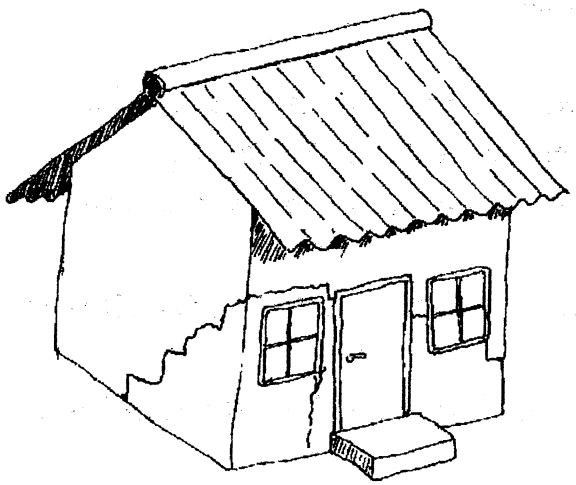
There are many good quality paints now available in Zambia. Look out for known trade names such as Dulux or paints approved by the Zambian Bureau of Standards.

Always read the manufacturers instructions on how to use the paint and prepare the surfaces carefully and follow them.

SUBSIDENCE

Problem: Severe cracks in the walls, diagonal or vertical, and large at the top, tapering down to hairline at the bottom.





Cause: Movement in the foundation caused by subsidence of the soil and or inadequate foundations for the type of soil. This is often worsened by poor drainage around the building for surface rainwater run off.

Solution: Refer to the section on **Foundations and underpinning.**

CEILINGS

CEILING BATTENS

Problem: Ceiling sagging.

Cause: Ceiling battens or "brandering" have become loose due to old age, or damage caused by termites or damp rot, or the ceiling boards may be too thin and the nails too small.

Solution: Carefully, remove the cover strips and then the ceiling boards. Examine the battens and remove all loose or damaged battens. Replace the battens with new ones and then replace the ceiling boards and cover strips.
If there is any sign of termites, refer to the section on treatment and termite ingress.
If there is any sign of damp rot and moisture in the ceiling refer to the section on roof sheets.
Make sure the ceiling boards are strong enough for the job and that the nails used are the right size. This varies but a competent carpenter will advise you.

CEILING BOARD

Problem: Sagging or damaged ceiling boards

Cause: The ceiling may become damaged due to rain leaking through the roof sheets and dripping onto the ceiling board causing it to rot quickly.

Solution: Remove the damaged ceiling boards and carefully examine the roof sheets for leakage. Repair the leaks as described in the section on roof sheets and then replace the damaged ceiling boards using at least 8mm thick ceiling boards and paint.

PAINTING

Problem: Dirty, peeling, blistering or flaking.

Cause: Age, loss of adhesion because of moisture in the ceiling or poor preparation for painting, and poor quality paint.

Solution: For moisture in the ceiling remedy the cause, refer to the section on roof sheets.
Strip the paint completely back to the ceiling board, ensure that the area is completely dried out, and repaint as follows.
First apply one coat of good quality undercoat, followed by a minimum of three coats of good quality gloss or PVA paint as required.

There are many good quality paints now available in Zambia. Look out for known trade names such as Dulux or paints approved by the Zambian Bureau of Standards.

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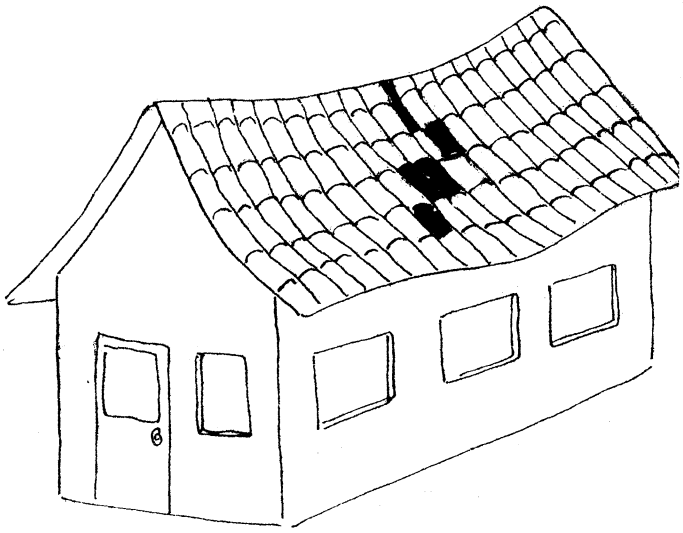
ROOFS

ROOF TRUSSES



Problem: Sagging or damaged roof timbers.

Cause: Poor roof construction or damage caused by damp rot or termites.

Solution: Carefully, inspect the roof timbers for damp rot or termites. If damp rot or termites are the cause of the problem refer to the sections on roof sheets or treatment and termite ingress.
In severe cases the roof may have to be taken down and reconstructed as new.
Where the timbers remain in good condition but the truss joints have failed due to poor construction, it may be possible to jack up the truss using acrow props or gum poles. Then strengthen the joints.

Weakened joints may be strengthened by introducing splices across the joints carefully nailed in place either side of the original joint using similar sized timbers at least 600mm long. All the joints must be carefully inspected and nails checked. Any loose nails should be hammered home and additional nails hammered in to provide a minimum of 6 nails per joint.

Areas of damp rot or termite damage must be removed completely. The affected truss must first be supported by acrow props or gum poles.

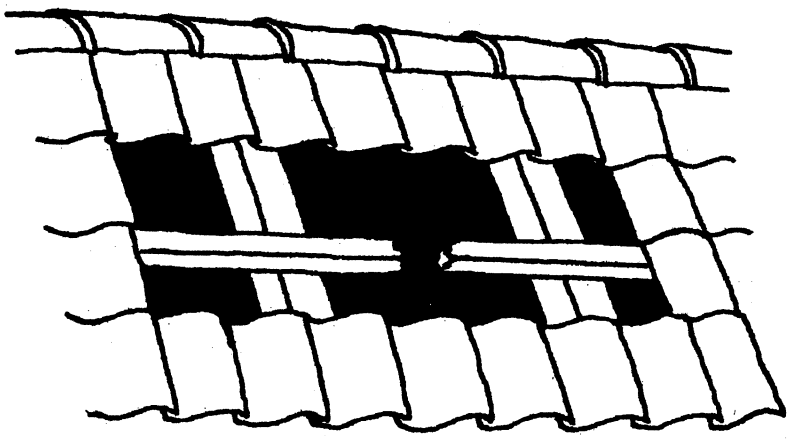
NOTE A technical supervisor must supervise this kind of work. Always put **SAFETY** first.

Once the truss is securely supported the affected timber may be cut out and a new piece spliced into place.

PURLINS

Problem: Roof sheets sagging between trusses.

Cause: This is usually due to the purlins deflecting, either because of age, due to damp rot or termite attack, or because the timbers used are too small for the job.



Solution: Carefully, inspect the purlins to find out why the deflection is there. Purlins that are damaged or too small should be identified, removed and replaced.

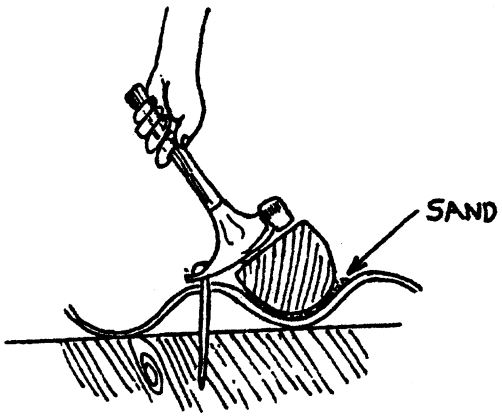
The roof sheets will have to be carefully removed first, then any damaged purlins should be removed completely and replaced with new purlins of the same size. Under sized purlins should be replaced with larger ones.

Your Buildings Officer will help you decide the correct size to use. Do not attempt to splice the purlin as this does not result in a satisfactory repair.

Then replace the roof using new roofing nails with rubber and felt washers to make sure the nail holes are sealed well.
The cause of the problem should then be solved. If damp rot or termites are the cause of the problem refer to the sections on roof sheets or on treatment and termite ingress.

REMEMBER:- Consult your District Buildings Officer for advice on the type and size of purlins you will need for your type of roof.

ROOF SHEETS



Problem: Leaky roof.

Cause: Cracked or damaged roofing sheets, age and wear allowing iron sheets to become rusty in the rain.

Solution: No matter what type of roof sheet, asbestos or galvanised iron, damaged roof sheets should be removed and replaced with new sheets of the same size. If the sheets are in good condition and the leaks are coming through the roofing nail positions, carefully remove the nails and replace them with new roofing nails with rubber and felt washers.
Other holes can be sealed using Roofing Compound, bitumen or silicone sealant.

HINT Do not use cement for repairs because it is brittle and will crack.
Painting the sheets with good quality roof paint may lengthen the life of iron sheets. Firstly the sheets should be thoroughly cleaned and sanded to provide a good surface, then apply one coat of priming paint and two coats of roof paint.

TIMBER TREATMENT & TERMITE ATTACK

Problem: Ant and termite ingress and attack.

Cause: Untreated roofing timbers and/or no ant guard.

Solution: Firstly check if there is an ant guard, if there is no ant guard refer to the section on ant guards.
Next, locate the affected areas of the roof and repair as described above.
The timbers should now be thoroughly treated to prevent any further attack.
A good treatment for all roofing timbers is to apply three coats of creosote or carbolinium, or any similar approved timber preservative. These chemicals can be very expensive but you can mix the preservative with used engine oil in the ratio 1:5 creosote: used oil.

To make the mix soak well into the timber, it can be heated up slowly over a **low** heat before painting. Do not allow the mix to become very hot. The mix may become flammable if exposed to naked flames and high temperatures. Just apply enough heat to make the mix thinner and easier to apply by brush.

GUTTERS AND VALLEY LININGS

Problem: Blocked and leaking gutters or valley linings.

Cause: Gutters will leak when they become full of leaves and debris blown on to the roof from nearby trees, when the gutter joints fail through age and rusting, or if the gutter is too small.

Solution: Keep the gutters clear of leaves and debris all year round.
Check all the gutter joints for leaks and rust. Soldering can repair leaks. A good mechanic or builder with soldering skills should be contracted to carry out the work. The gutter must be thoroughly cleaned, all rust removed and then allowed to dry out completely. The joint can then be soldered closed and tested to make sure the repair has been successful.
Badly rusted and leaky gutters should be removed and replaced with new gutters. Gutters that are too small to take heavy rainfall should be replaced with larger ones
Small leaks may be sealed with silicone sealant.

HINT Gutters are not necessary in most cases. If there is no main drain or gully for the water to run into, leave the gutters off and control the flow in simple brick dish drains around the building. If you can leave them off, it will make maintenance of the roof much simpler.

FLASHING

Problem: Leakage through the flashing.

Cause: The flashing may have come away from the wall allowing rain water to run down the wall and under the roof sheets, or the joints between the flashing sheets may have failed through age and rusting.

Solution: Carefully inspect the flashing; if the plaster that holds the flashing tight to the wall has cracked and come away, remove all the damaged plaster, carefully push the flashing back into its original position tucked into the face of the wall and re-plaster the flashing into place using a 1:3 cement: sand mix. At the positions of the joints between each sheet apply a silicone seal to ensure that moisture does not seep in between them.

FASCIA

Problem: The timber fascia board becomes damaged, loose and rotten.

Cause: Damp rot, age and termite attack may all cause the fascia to fail.

Solution: The damaged fascia boards should be removed and replaced by new treated and painted timber fascia or asbestos fascia which will not be affected by damp or termites.

HINT The fascia may be omitted completely as the only service it provides is decorative. This option is preferred as it will stop the need to replace again and help reduce maintenance.

WINDOWS AND DOORS

DOORS AND DOOR FRAMES

Problem: Rotten or damaged doors. Rotten, rusted, damaged or broken door frames.

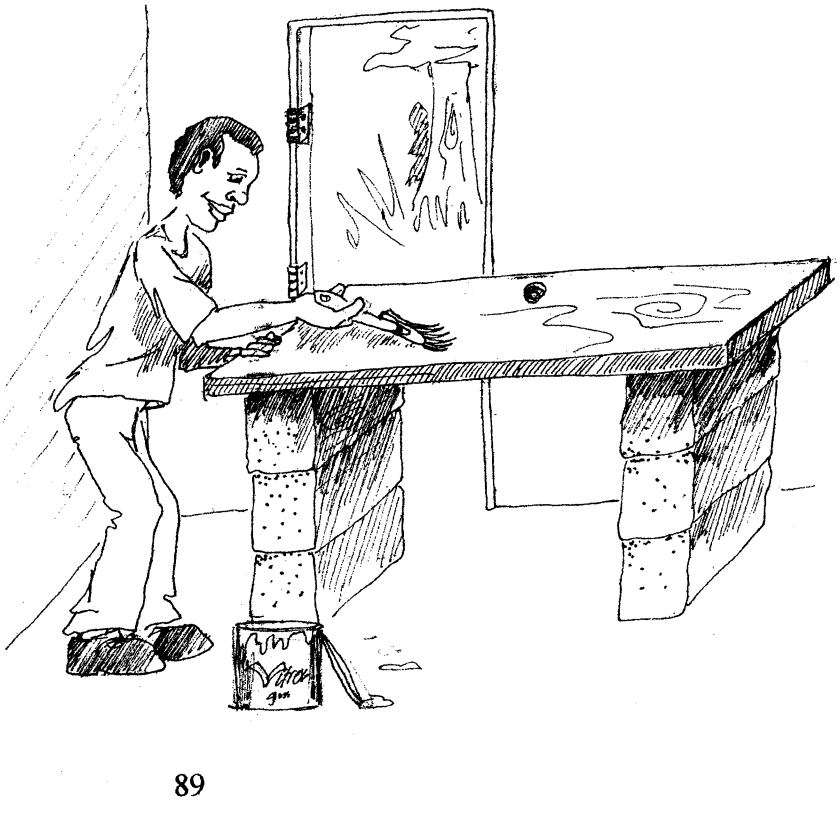
Cause: Weathering, ants, heavy daily wear and tear & vandalism, or poor quality.

Solution: Rotten doors should be replaced with solid timber doors. Avoid flush plywood doors as these are not durable.
Rusted metal frames should be scraped and sand papered, then touch up areas of exposed steel with red oxide primer and two fresh coats of good quality gloss paint.
Rotten wooden frames should be removed completely and replaced with new hardwood treated frames or steel frames.

Paint doors and frames periodically for protection. Fittings should be removed before painting, cleaned and re-fixed after the paint is dry.

REMEMBER: - The durability of doors also depends on the quality of the door, locks and handles used.

It is recommended that **solid hardwood** doors be used **everywhere**.
Never use flush plywood or particleboard for any door.



WINDOW FRAMES

Problem: Rotten, rusted, damaged or broken window frames.

Cause: Poor quality, heavy daily wear and tear, vandalism or theft.

Solution: Window stays and handles should be constantly monitored to make sure that all screws are tight. Missing or poor quality stays and handles should be replaced.
Rusty frames should be scraped and sand papered, then touch up areas of exposed steel with red oxide primer and two fresh coats of good quality gloss paint.
Rotten wooden frames should be removed completely and replaced with new hardwood treated frames or steel frames.

LOCKS AND HINGES

Problem: loose, broken, missing or jamming.

Cause: Poor quality, heavy daily wear and tear, vandalism or theft.

Solution: Door hinges, locks, stops, striking plates etc. must be securely fastened.
Always use wood screws and not nails for fixing hinges and locks.

Make sure the hinges have all the screws in place and that they are tightly screwed in place. Replace any loose or poorly fitting screws.

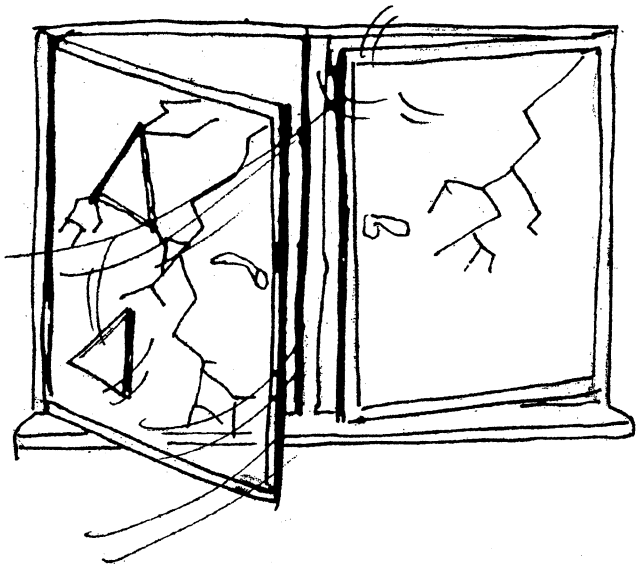
Remember:- Tightening loose screws does not cost anything, replacing screws or fittings does!

Locks that are broken should be replaced with good quality 3 lever mortise locks. Beware of cheap locks as they will be poor quality and will not last long.
Remember that not all mortise locks are good and durable.

BEWARE:- check the trade name carefully, there are many cheap copies using similar sounding names. One example is **UNION** LOCKS which are good quality, and **ONION** LOCKS which are weak and of poor quality.
They sound similar and it would be easy to make a mistake and buy the bad ones.

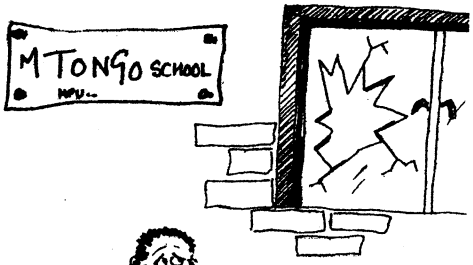
Oil the locks and hinges regularly to avoid jamming. If mortise lock can be avoided, use a simple staple hasp and heavy padlock instead.

GLAZING



Problem: Broken, dirty or missing.

Cause: Broken stays and handles allow the window to swing in the wind and cause the windowpanes to break. Poor quality or old putty cracks and falls out. Poor cleaning and vandalism.

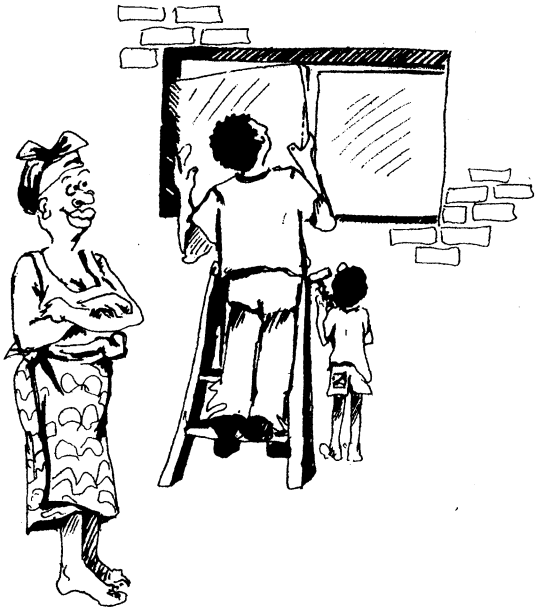


Solution: Poor quality stays and handles should be replaced with good quality ones. Broken stays and windowpanes must be replaced immediately.
Keep your windows clean at all times.
Replace old cracked putty and only use good quality putty. Do not use cement.

Remember :- Avoid ball games close to windows.

HINT

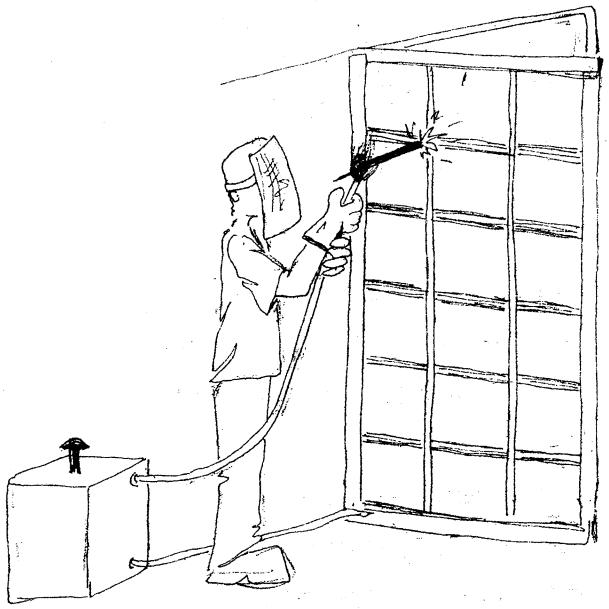
If your windowpanes are large, you can have them divided into smaller panes by a good welder to avoid costly large window replacements. Or use 4mm glass instead of 3mm for these large panes.



BURGLAR BARS

Problem: Rusty, peeling paint, loose.

Cause: Poor painting, age, wear and tear.



Solution: The bars should be scraped and sand papered, then touch up areas of exposed steel with red oxide primer and two fresh coats of good quality gloss paint.
Loose bars should be removed completely, and re fitted either by welding to the window or doorframe, or by casting the bars into prepared holes with strong cement: sand mix. The holes should be carefully prepared by removing all loose bricks, mortar and dust. Use a dry mix and ensure the bars are left for at least three days before using the window or door.

WATER SUPPLY AND PLUMBING

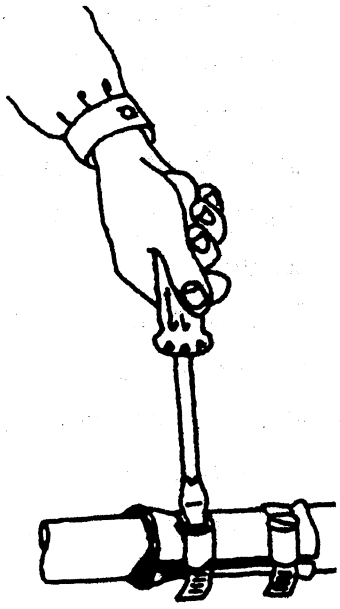
PIPE RETICULATION

Problem: Leakage's and deterioration.

Cause: In time joint seals fail and the pipe will leak

Solution: Repairing leaks in the pipes is plumbers work. Contract a qualified and experienced plumber to check and fix these leaks. Monitor his work to make sure the proper materials are used. Never allow a plumber to use strips of plastic bag in stead of PTFE (PolyTetraFluoroEthylene) thread tape or hessian and sealing paste.

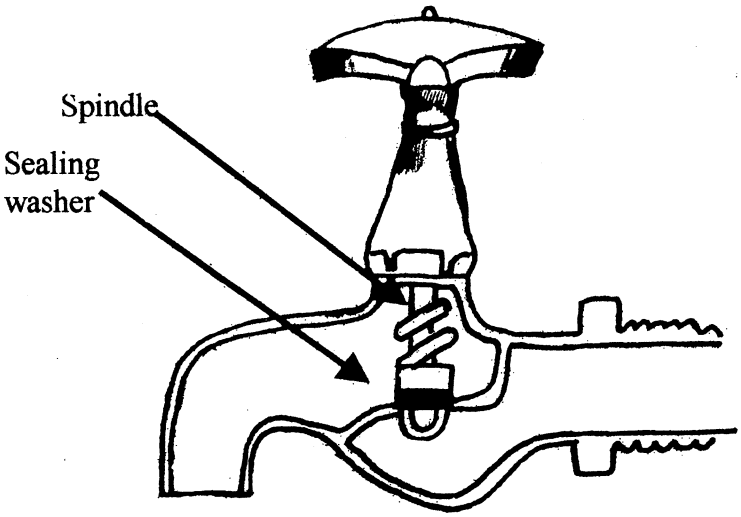
A temporary repair can be made by fitting a piece of hosepipe, cut open one side, around the pipe and fixed with hose clamps.



TAPS AND VALVES

Problem: Leakage's.

Cause: Failed sealing washers.

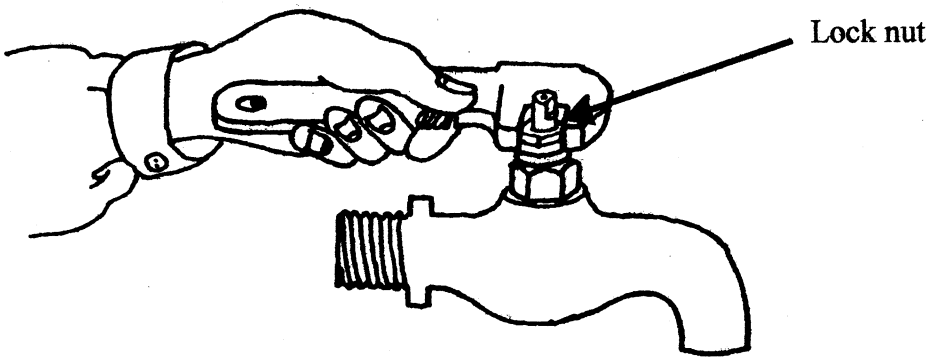


Solution: Repairing taps and valves is easy once you know how. Inside the tap is a spindle with a rubber-sealing washer at the end. When the tap is closed the washer pushes against the opening and stops water flowing. When the washer gets worn the tap will not close fully and will drip. The washer must be replaced.

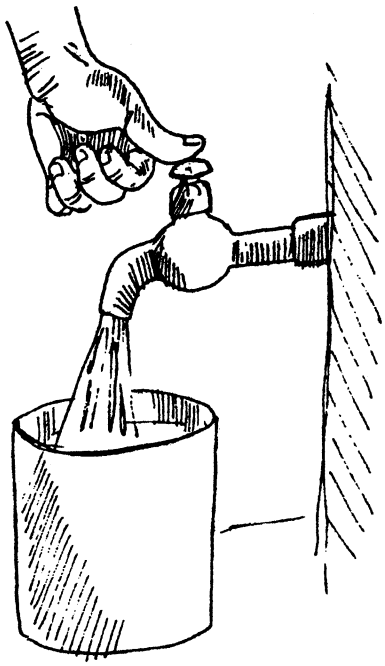
- Find and close the nearest valve or stop cock.
- Open the tap to release any water in the pipes.
- Unscrew the top part of the tap with a shifting spanner. Sometimes a screw under the coloured cap on the tap has to be loosened first.
- Lift out the spindle and replace the rubber washer with a new one. Washers should be available from your local hardware.
- Temporary washers may be cut from old inner tubes from car wheels.
- The washer may be simply pressed in place or fixed with a small screw or nut.
- Reassemble the tap and check to see if it works.
- If it does not, then the seat may be too worn and a new tap will be required.

If you are not sure how to do this, then contract a qualified plumber to check and fix these leaks. Monitor his work to make sure the correct materials are used. A member of the maintenance committee should watch and learn how to do this work. Keep a supply of tap and valve washers to repair them yourself next time.

If the tap leaks from the bottom of the handle then the sealing gasket is worn. Remove the handle and tighten the lock nut over the gasket until the leaking stops or replace the gasket if necessary.



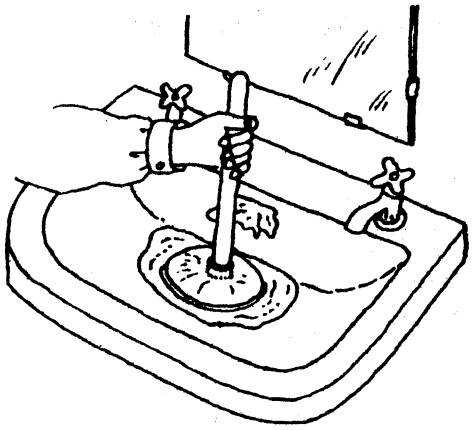
Remember: - Push button taps are much stronger than conventional ones and prevent water wastage as result of continuous running of taps.



BASINS

Problem: Blocked or leaking waste trap, or loose basin.

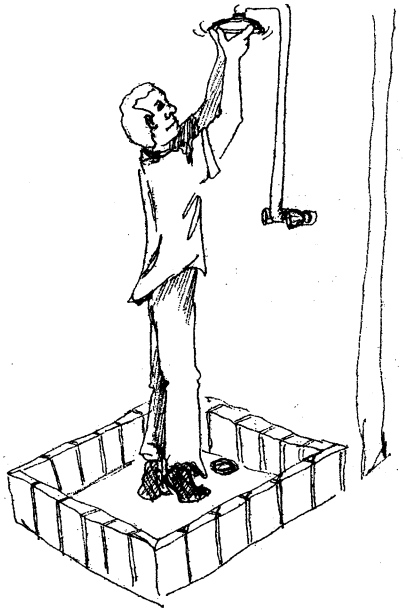
Cause: Waste trap full of dirt or debris, worn washers or seals. The screws holding the brackets, which support the basins` , are loose.



Solution: Use a rubber plunger to free the blockage. If this fails, remove the waste trap and remove the debris. Replace the washers if necessary and tighten the pipe fittings. Serious blockages may call for the plumber to sort out.
Do not allow debris to be washed away in the basins.
Tighten or replace the bracket screws.

SHOWERS

Problem: Missing shower rose, leaking taps, blocked waste trap.



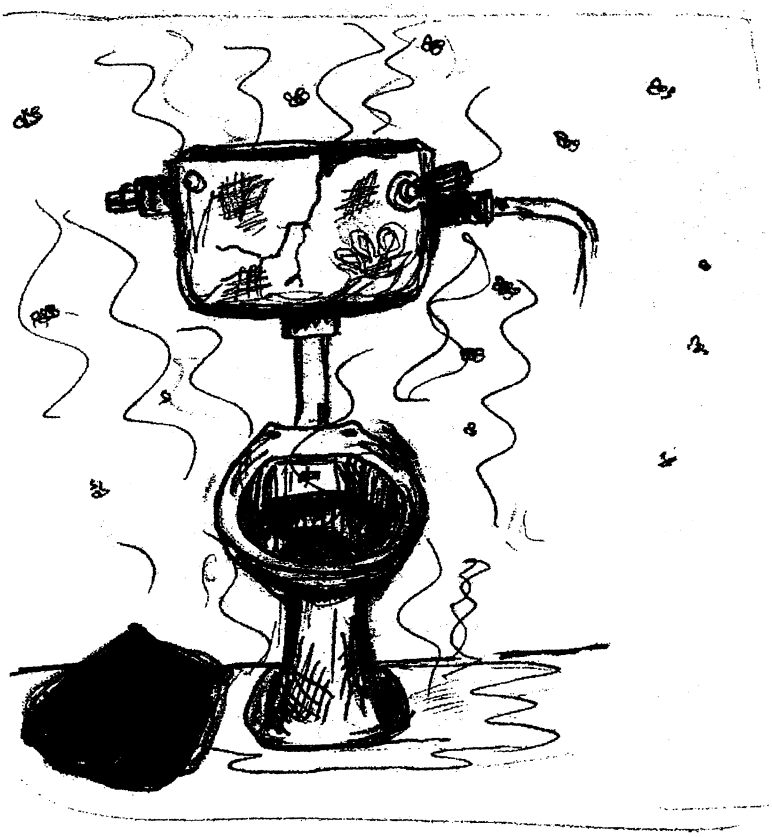
Cause: Poor fittings, wear and tear, inadequate cleaning.

Solution: Replace missing shower roses and make sure they are screwed tightly in place.
Repair the tap washers or replace the taps with quality durable taps suitable for heavy use. Ball valve type taps are good.
Make sure the waste is kept free and clean at all times, through regular cleaning.
If the waste pipes are blocked call the plumber to rod the system out.

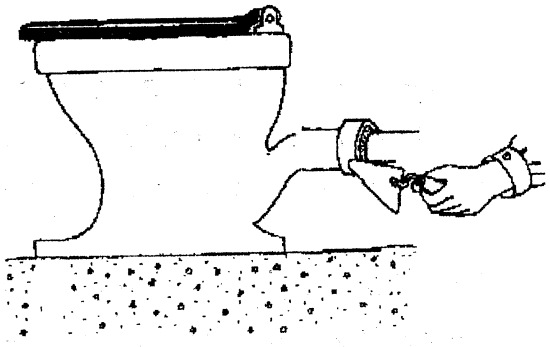
TOILET BOWLS

Problem: Blocked, leaking, not flushing or foul smelling

Cause: Waste trap, pipe or manhole blockage, cracked or loose connections or damaged vent pipe.



Solution: Regular monitoring of the toilets is essential to make sure that it works properly. As soon as the toilet stops flushing, it will quickly become blocked. Stop use until it is fixed. The blockage must be removed by rodding the sewer pipes, clearing the waste traps and the manholes outside.
Then flush the system with lots of water until it runs freely.
If this fails, call a qualified plumber to finish the job.
Check the connection between the bowl and the sewer pipe, it may have to be redone.

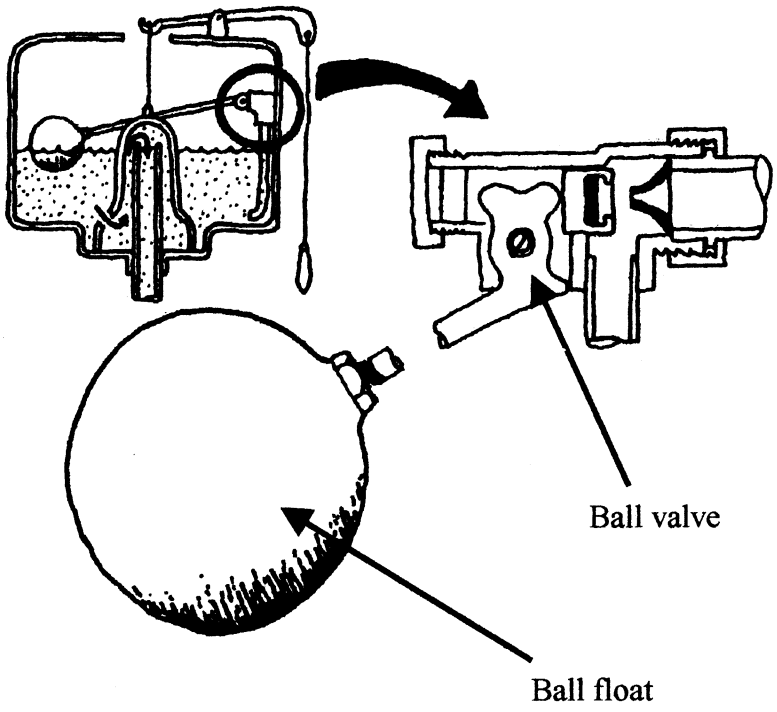


Once the toilet flushing system is fixed, you can start to use the toilet again.
Check the vent pipe for damage or blockages and replace or clear it as necessary. Make sure that there is a balloon grating on the top to prevent flies and debris entering.
With everything working, and good cleaning, the toilet should not smell.

TOILET CISTERNS

Problem: Toilet not flushing, cistern overflowing, broken handles.

Cause: Poor quality fittings and heavy, daily wear and tear.



Solution: Replace poor quality plastic fittings with a good quality metal system with sturdy handles suitable for heavy use. A qualified plumber should fit these. Check the ball float in the cistern, it should float high and will stop the water when the cistern is full. If the float has water in it, replace it.

OVER HEAD TANKS

Problem: Over flowing or leaking.

Cause: The ball valve that stops the water flowing may be stuck open or broken. Steel tanks will rust and eventually spring leaks around the bottom. Concrete tanks will leak through shrinkage cracks.

Solution: Check the ball valve, make sure that it works properly and check the ball float in the tank, it should float high and will stop the water when the tank is full. If the float has water in it, replace it.

If a steel tank leaks a little, empty the water and have the leaks welded, prime the tank with red oxide paint and then apply good quality gloss paint, but only if funds are available as this is for appearance only.
If the leaks are very bad, take the tank down, weld shut the access hatch, turn the tank over so the bottom is now at the top. Prime the tank with red oxide paint and then apply good quality gloss paint and raise the tank back into place.
If a concrete tank leaks a little, empty the water and locate the cracks, rake out the cracks internally and externally, clean and wire brush the surface and repair using a 1:3 cement : sand mortar. Allow the repair to dry for at least 7 days and then apply 3 coats of bituminous paint internally.
If the tank is beyond repair, consider replacing it with a fibreglass or plastic tank, which will give you a long lasting maintenance free tank.

BORE HOLES AND ELECTRICAL PUMPS

Problem: The borehole may become dry or produce very muddy water and the electrical pump might develop a problem or break down.

Cause: The water in the bore-hole may not be enough to cope with the demand causing the pump to run dry or the lower end of the bore hole may have collapsed or the pump has fallen below the lined hole causing mud to be pumped up.

Solution: If the water in the hole is inadequate, the only solution is to deepen the borehole. This unfortunately is expensive and will have to be done by a bore hole-drilling contractor.

If the pump is not working, it must be raised carefully and repaired. Seek advice from a specialist to find out what equipment and techniques are used to raise the pump.
IF you drop the pump down the borehole, it is very difficult to retrieve it, sometimes impossible. Be very careful.

If the water has become muddy, the bore hole pump must be raised above the bottom of the lining to pump clear water or the lining will have to be extended. Make sure that someone on the maintenance committee is trained to do this.

If the yield of the borehole is poor, the borehole may need to be deepened. If this does not improve the yield,
a new borehole may be necessary. Ensure that a new site is properly investigated by the bore hole company before agreeing to go ahead. Boreholes are expensive.

STAND PIPES

Problem: Broken and missing taps, poor drainage around the standpipe, and poor cleanliness and hygiene.

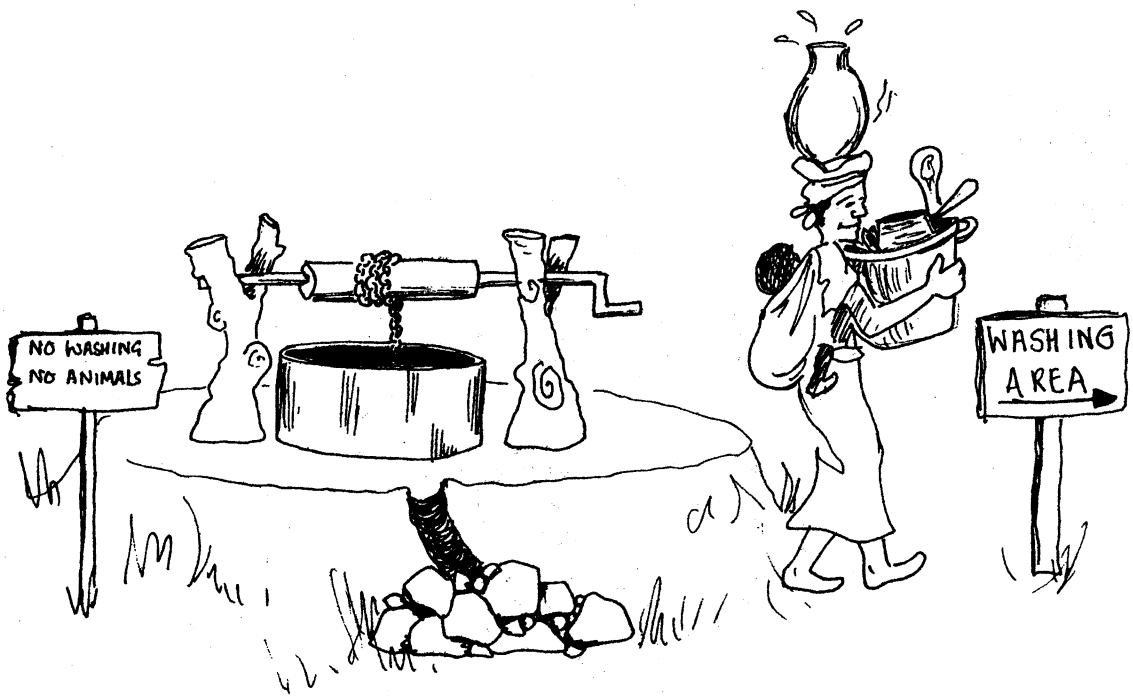
Cause: Poor maintenance and management, and vandalism.

Solution: Firstly ensure that there is somebody responsible for each standpipe, who maintains and monitors it. Fit strong quality taps and have washers available to replace worn ones (refer to the section on plumbing and taps). Keep the area clean and dry, and make sure that the water drains freely away from the standpipe apron to a soak-away. Keep the soak-away free from rubbish, leaves and grass. People tend to use the soak-away as rubbish pits. Do not allow this. If it is possible, in the evenings or times when water might not be available, remove the tap and turn the stopcock off. This will deter vandals from trying to steal the taps.

WELLS AND WINDLASSES

Problem: Contamination, missing chains and buckets.

Cause: Poor maintenance and management, and vandalism.



Solution: Your well must be maintained daily to ensure that it works well and is clean. The well head cover should be fixed securely in place and kept closed when the well is not being used.

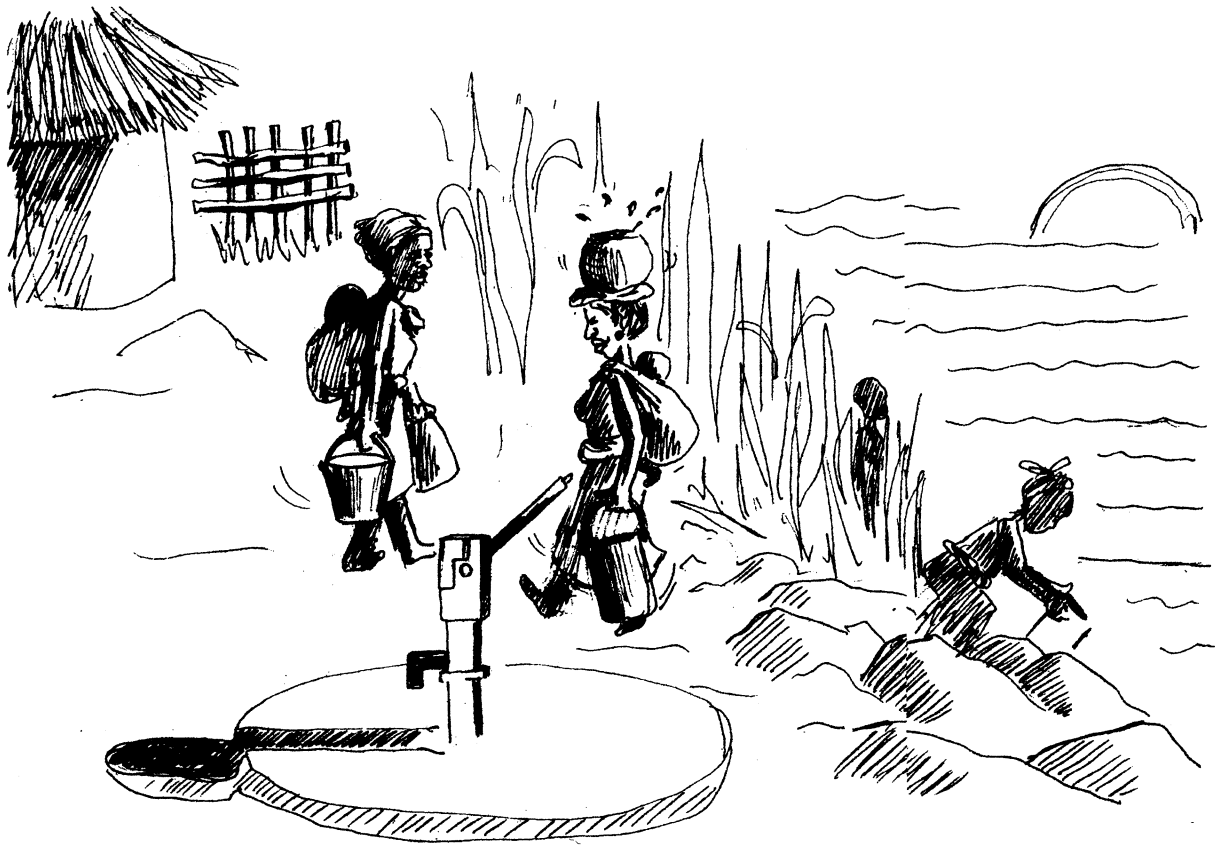
If anything falls into the well, remove it immediately. This should be done by an adult, lowered using safety ropes and must be well supervised.
Check the chain and bucket every day. These must be fixed securely to the windlass so they do not fall into the well.

Do not allow other buckets to be used for drawing water.
Do not wash clothes or children near the well and keep livestock away from the area.

Keep the windlass well greased and in good condition. Timber ones may be treated with oil and replaced as and when they get worn.

Make sure that there is a well-drained hard surface around the well so that spilt water flows away easily, preventing the area becoming muddy and dirty.

HAND PUMPS



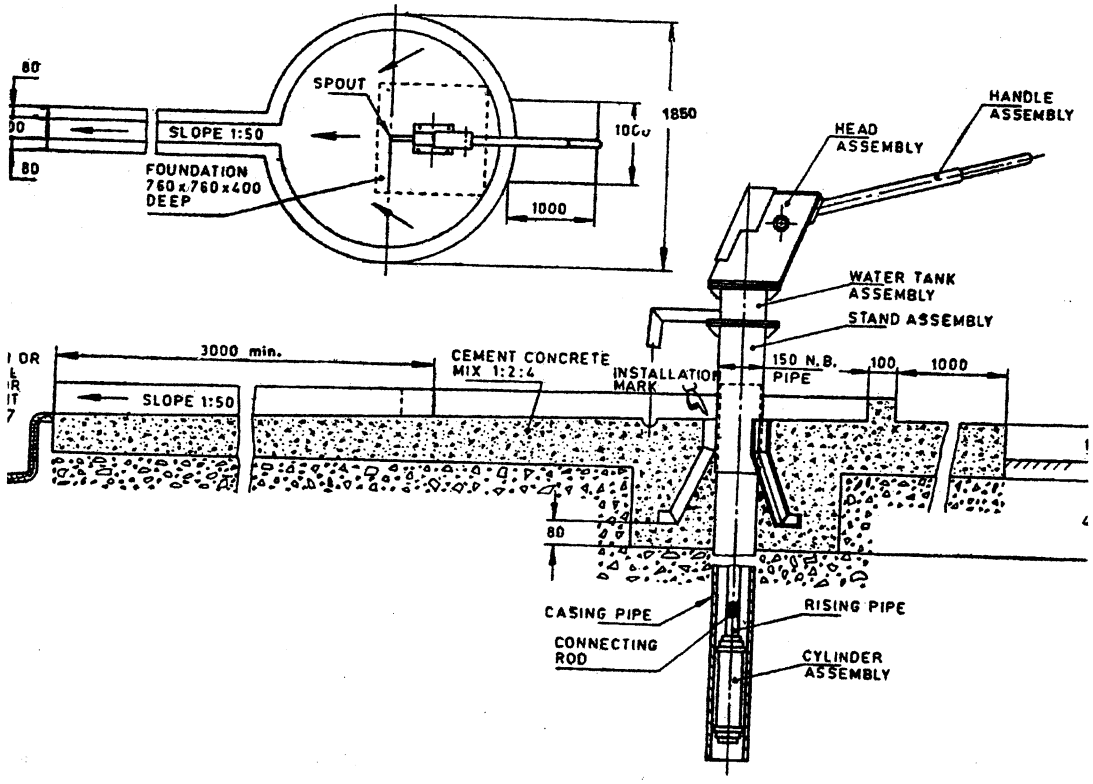
Problem: Pump does not raise water, poor drainage around the pump, and poor cleanliness and hygiene.

Cause: The pumps usually break down due to the rubber valve in the pump wearing out or perishing.
Inadequate drainage around the pump and lack of knowledge with regard to hygiene and water results in poorly kept, muddy areas.

Solution: These pumps are usually quite easy to mend as they are very simple mechanically. Contact the contractor who sank the borehole and installed the pump. He will show you how to strip and repair the pump and how to raise it out of the borehole.
Make sure someone from the committee learns how to carry out this work.

Find out where you can find spare parts for your pump, and how to replace washers or valves that will perish in time.

It is often possible to make a temporary washer or valve from old inner tubes from car wheels.



Make sure that there is a well-drained hard surface around the well so that spilt water flows away easily, preventing the area becoming muddy and dirty.

Do not wash clothes or children on or near the borehole apron, and keep livestock away from the area.

FOUL SEWERAGE

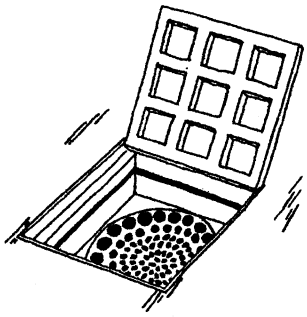
FOUL WATER MANHOLE

Problem: Blockage

Cause: Heavy usage and/or small pipes causing blockage of solids, the use of news paper in stead of toilet paper, broken toilet flushing system, or a missing manhole cover allowing earth & debris to be thrown or blown into the manhole.

Solution: Regular monitoring of the manholes is essential to make sure that they work properly. Remove the manhole covers and clean thoroughly, remove all solids. The branch drains should be cleared using drain rods. Then drains thoroughly flush with clean water to make sure the drains run freely. Replace any broken or cracked manhole covers immediately.

GULLIES AND TRAPS

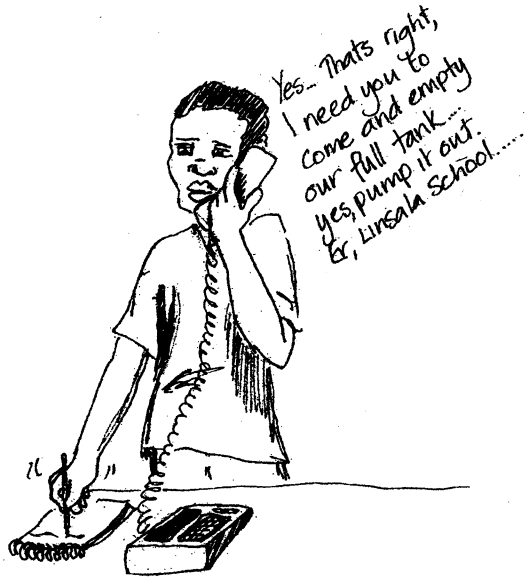


Problem: Blockage.

Cause: Wind blown or swept earth or debris falling into the gullies or traps.

Solution: Regular monitoring of gullies & traps is essential to make sure that they are cleaned out and do not become blocked.
Note: They are there to collect debris and stop the system getting blocked. Clear them often.

SEPTIC TANKS



Problem: Full and over flowing.

Cause: Heavy use and time cause the septic tank to fill.

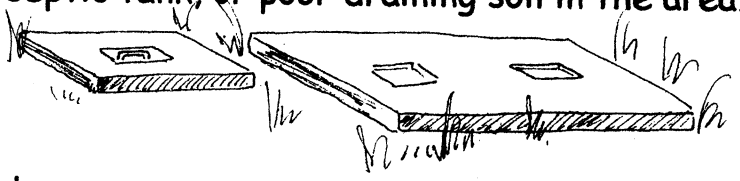
Solution: The septic tank needs routine monitoring and when the sludge (solid substance) nears half full, it should be removed from the tank. Then flush the tank with water and put it in service again. Severe back up of sludge may need to be pumped out or treated with chemicals to break it down for pumping.

This is specialist work that the council will advise you on. Some councils will send special trucks to pump the sludge out. If this is not possible to arrange, the sludge will have to be taken out manually in buckets.

SOAKAWAYS

Problem: Blockage by sludge (solid waste) overflowing from the septic tank, or under sized soak-away.

Cause: Over full septic tank, or poor draining soil in the area.



Solution: The soak-away should be checked for sludge together with the septic tank. Any sludge in the soak-away should be cleared immediately. If the soak-away floods often, then build a larger one.

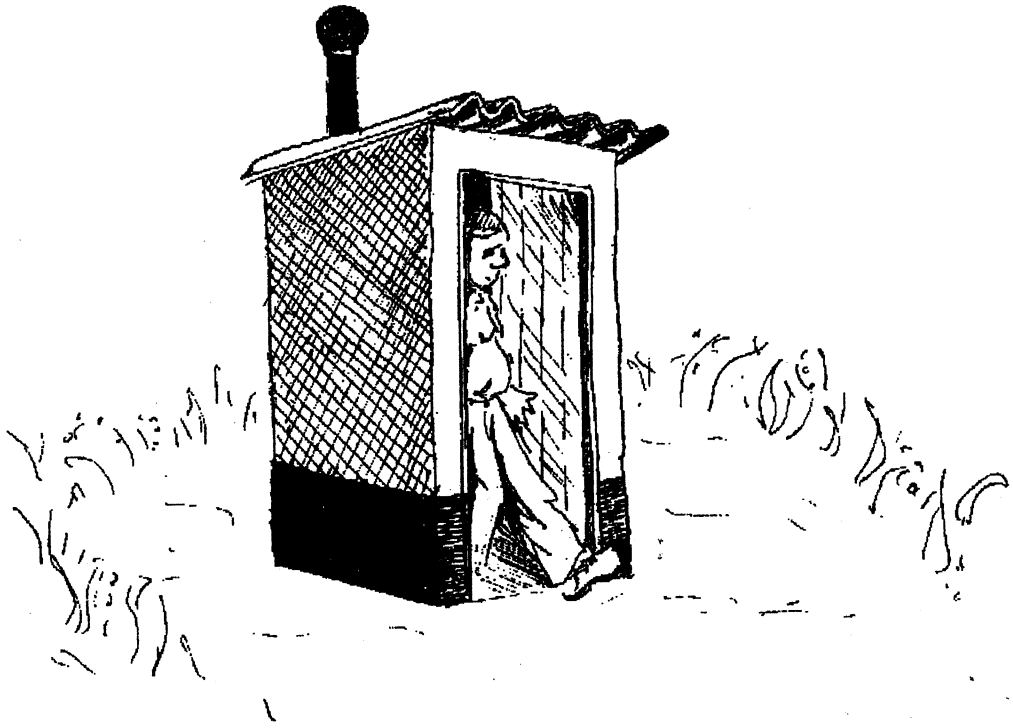
VENTILATED IMPROVED PIT LATRINES

Problem: Foul smelling, dirty or overflowing.

Cause: Inadequate cleaning and disinfecting or the latrine may be full.

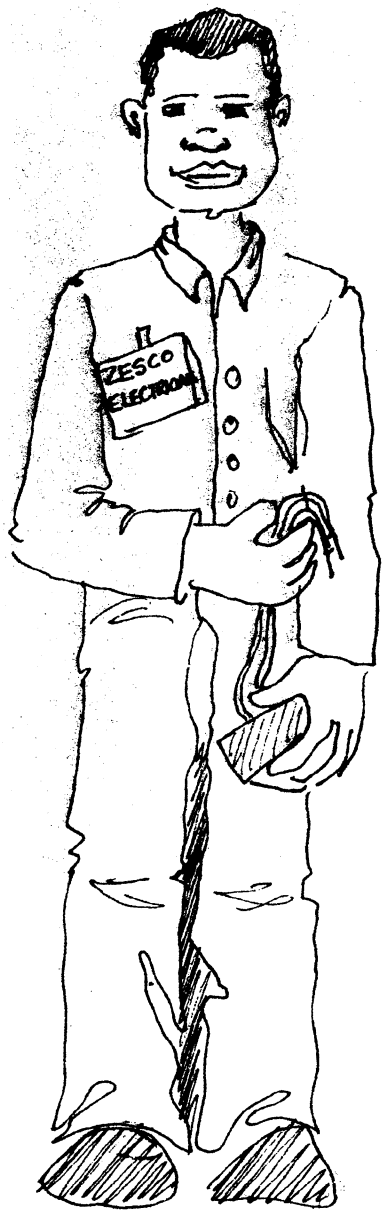
Solution: Ensure that these basic rules are followed:

- Do not permit urination on the outside of the wall.
- Keep the squat hole covered.
- Keep the concrete slab washed and disinfected.
- Flush water into the pit each week.
- Check the level of the pit every 6 months and if the level is higher than one third of the pit depth, then remove the sludge. This can be done using a bucket or if possible a `sludge` pump. The council and some private operators can be contacted to do this.



ELECTRICAL

SAFETY PRECAUTIONS



Only qualified electricians should carryout electrical works. All electrical fittings should be monitored daily and all faults reported for repair by a qualified electrician. Naked wires, broken sockets and switches, and damaged light fittings are dangerous and must be dealt with quickly.

Make sure that all electrical equipment has a good plug fitted. Never push naked wires into the socket, this is very dangerous and could cause death by electrocution.
Electricity is very dangerous. Never carry out the work yourself, call the **electrician.**
The only maintenance you may carry out is to replace broken light bulbs. When replacing light bulbs, turn all the fuses in the D.B. (Distribution Box) to **OFF** before doing the job. This may seem to be inconvenient, but it will save lives.

If you are not sure, call the electrician

SWITCHES AND SOCKETS

Problem: Broken, loose and not working, sparks.

Cause: Wear and tear, poorly fitted and poor quality fittings.

Solution: Call the **electrician**, NEVER try to fix any electrical fitting yourself.
Make sure that any new switch or socket is of good quality. Do not accept any thing less. The extra cost will be worth it.

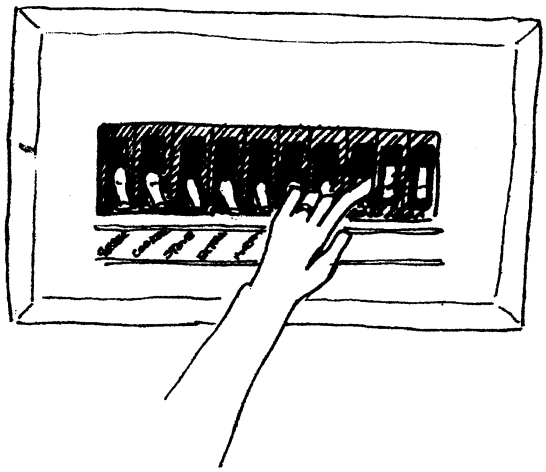
WIRING AND CONDUITS

Problem: Loose and faulty wiring, sparks, damaged and loose conduits.

Cause: Wear and tear, poorly fitted and poor quality fittings.

Solution: Call the **electrician**, NEVER try to re-fit conduits or fix or even touch live electrical wires. Keep everyone away from problem areas, until the electrician has completed his work and confirmed that it is SAFE.

MINIATURE CIRCUIT BREAKERS (MCB)



These are the fuses that protect the electrical system in your building.

Problem: The breakers will trip or turn off if there is a problem in the electrical system.

Cause: This could be caused by many electrical problems from over loading the system, to faulty wiring or branches falling on the cables.

Solution: Call the **electrician** to find out why the breakers are tripping and fix the problem.
Keep the miniature circuit breakers (MCB) in a sturdy locked box.

LIGHT SOCKETS AND BULBS

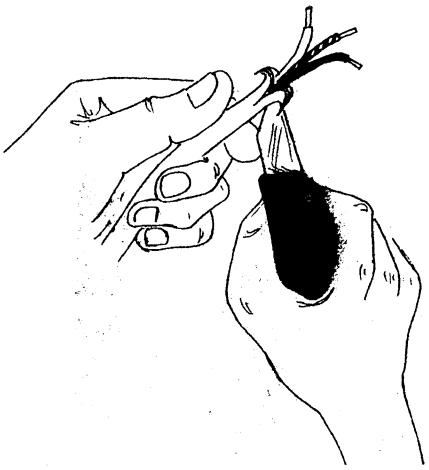
Problem: Blown electrical light bulbs, loose or damaged holders.

Cause: Wear and tear, bulbs will only last a certain time before blowing.
Poor quality fittings and wiring.

Solution: If the fittings are well fitted, there are no exposed wires and you have a solid safe platform to stand on then: First turn off all the M.C.B.`s, and then remove the old bulb carefully and replace it with a new bulb. Do not force it. If the bulb seems stuck, leave it and call the **electrician**.
If the fittings are poor and there are exposed wires, call the **electrician** to fix the wiring and replace the fittings with new good quality ones.

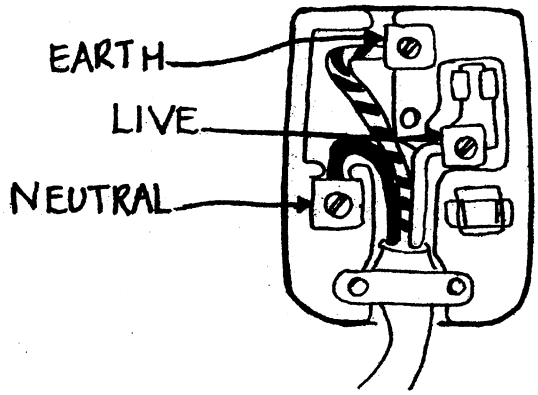
HINT Replace pin type light bulbs and fittings with fluorescent tubes and fittings. They cost more but last far longer.

FITTING A PLUG



First prepare the cable end by stripping the outer layer back to expose at least 25mm of the three wires in the cable. Usually the wires are brown (live), blue (neutral) and green or yellow (earth).

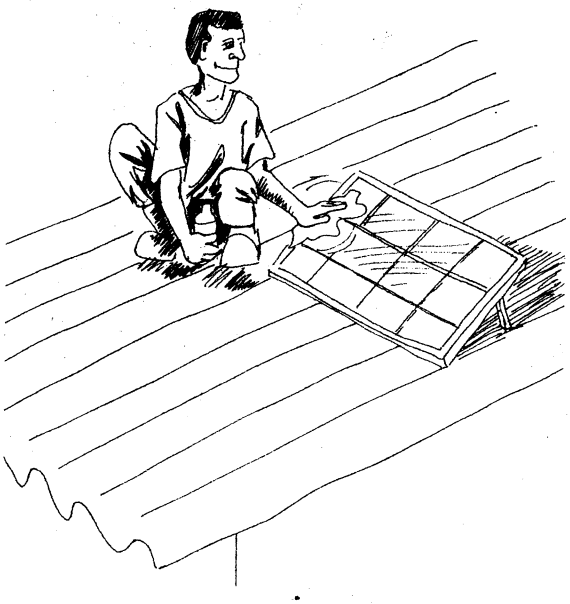
Remove the cover of the plug and connect each wire as shown. Then fix the plastic locking bar to secure the cable where it enters the plug; check that there is a 13-amp fuse in place, and screw back the cover.



SOLAR POWER

Problem: The solar panels become dirty, loose electrical connections, low battery water or poor battery performance.

Cause: Solar panels are exposed to the weather and get covered in dust and dirt carried by the wind and rain.
The dirt reduces the amount of sun shining on the panel and reduces the power made.
Electrical connections will become loose due to wear and tear or poor fitting.
The battery uses water as it is charged by the solar panels and in time the battery will become weak and eventually fail to charge up and need to be replaced.



Solution: Clean the solar panels every 2-3 months, follow the manufacturers` instructions and do not use rough cloth. Solar panels are fragile and expensive so look after them well.

- The electrical wires should be checked regularly and if found to be loose, call an electrician to fix the connections securely.
- Check the battery water every week and top up the levels with distilled battery water only. Never use tap water, as this will damage the battery severely.
- If the performance of the battery is poor, it is probably time to replace it. Call the electrician with a tester to check the performance of the battery.

FIXTURES

TABLES AND CHAIRS

Problem: Damaged and broken.

Cause: Age, wear and tear, poor quality, children playing on them, pulling or pushing instead of lifting them.

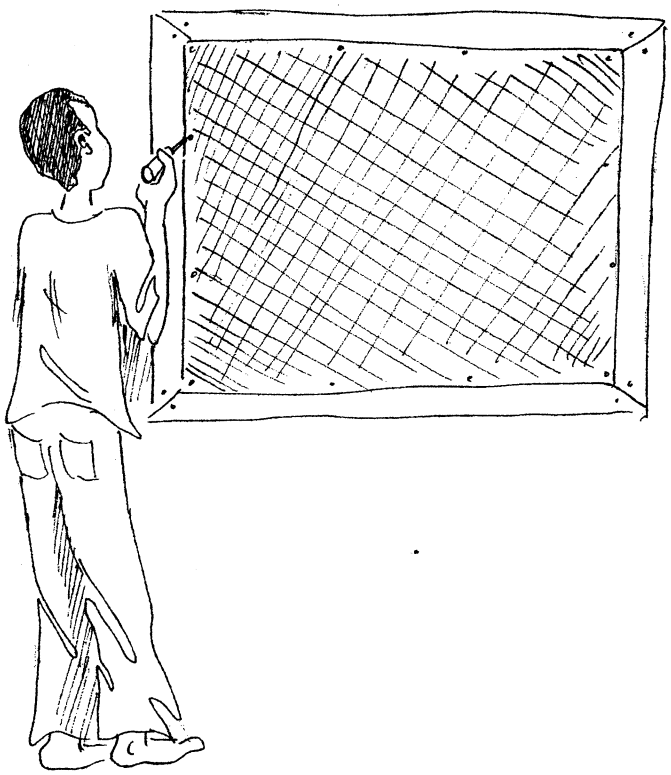
Solution: Monitor the condition of the tables and chairs regularly, and tighten all screws and bolts that are loose. Replace screws that will not tighten with larger stronger ones if possible. Replace any broken timber parts of the table or chair immediately they become damaged.
Poor quality tables and chairs will tend to break often. A qualified carpenter with joinery skills will be able to strengthen them, but eventually you will have to replace them with good qualit well made tables and chairs.
Make sure new tables and chairs are made with proper joints. These will be made with timber dowels or pins, wood screws and wood glue. Never accept a table or chair that has been put together with nails. It will not last.
Lift chairs to move them, and prevent children or adults misusing them.

BLACKBOARDS

Problem: Poor blackboard paint, scratchy surface, difficult to write on clearly, loose or cracked boards.

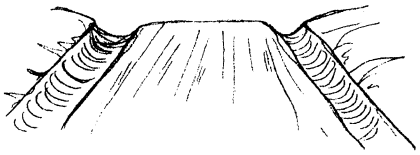
Cause: Poor quality black board paint, old worn surface being used, loose fitting screws, cracked plaster.

Solution: Use good quality chalkboard paint, do not use gloss black.
Cement: sand plasterboards should be re-plastered when necessary to provide a smooth even surface to write on.
Particleboard black boards should be replaced when necessary with new, and fixed securely to the wall with expanding wall screws. Existing screws should be checked and tightened as needed.



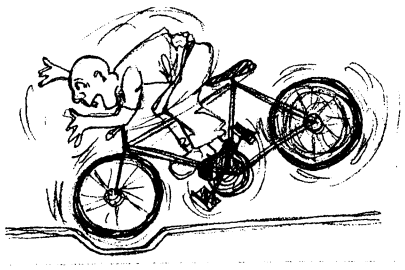
ROADS

GRAVEL AND EARTH ROADS



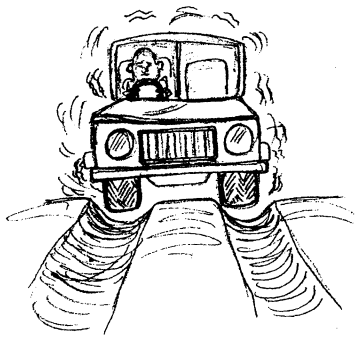
Loss of shape

Problem: Loss of shape, potholes, wheel ruts and corrugations or erosion gullies appearing on the road and loss of camber.



Cause: These problems are caused by normal use by vehicles combined with weathering in the rain and wind, rain water running off the surface and standing water due to poor drainage.
Wheel ruts, potholes and depressions form after time by vehicle wheels pushing the gravel outwards.
These ruts will stop the rainwater running off the road surface into the drainage ditches.

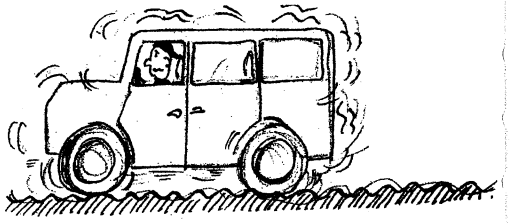
Potholes



Solution: The displaced gravel or laterite should be dug up and returned to the road, watered and thoroughly compacted to form a cambered cross section as the road was originally made.

Wheel Ruts

All potholes and depressions should be filled in with gravel or laterite watered and thoroughly compacted.



Frequent `condition based monitoring` should be carried out to identify areas of the road that may be becoming damaged early on, and repairs carried out as soon as possible.

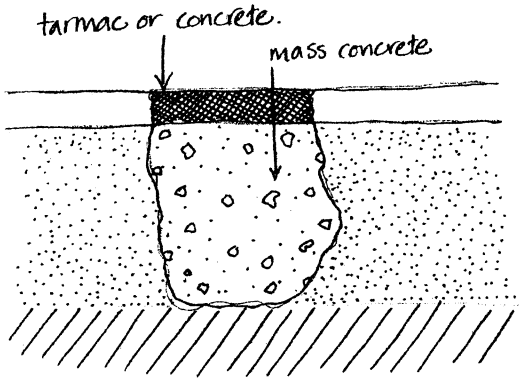
Corrugations

It is possible to divide the road into manageable lengths which would be monitored and maintained by one man, equipped with a wheel barrow, a shovel, a pick, a rake and a hand ram or `dindo`. His duty would be to walk the `length`, for example up to 2 Km, and carry out pothole filling, re-shaping the road to maintain the camber, and clearing the drainage ditches of mud and grass. These men would be known as `Line Men`. During monitoring, stretches of road that require constant work to maintain them could be identified as weak areas. Bring in additional good gravel or laterite, and compact the road using a mechanical compactor to reduce the amount of routine maintenance by hand can strengthen these areas.

TARMAC AREAS (Car parks, driveways. Hard standings)

Problem: Pot holes, surface breaking up and vegetation growing through the surface.

Cause: General wear and tear combined with poor drainage.



Solution: Cut back any damaged tarmac, to areas of good, unaffected tarmac and then dig down to solid ground. Then fill the hole with lean mix concrete, gravel or laterite and water and compact thoroughly with a steel `dindo` or ram. The surface may either be finished with tarmac mixed and compacted by hand or with cement stabilised laterite.

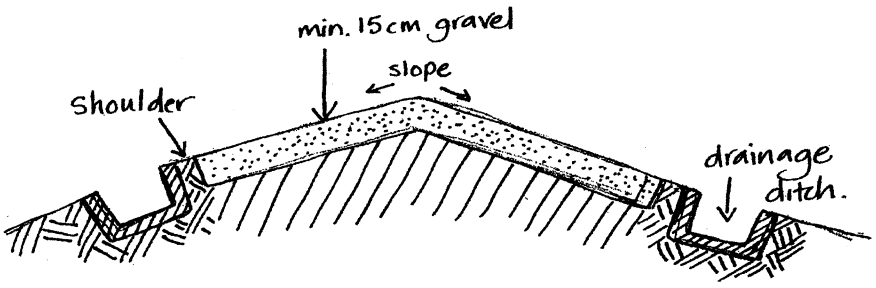
Cement stabilised laterite can be made by mixing cement and laterite in the ratio of 4-6% cement to laterite. The mix should be made and placed earth dry, watered lightly and compacted thoroughly by hand to the right level.

Check all the drains around the tarmac areas and ensure that these are clear and working well. Standing water will damage the tarmac.

DRAINAGE

Problem: Standing water and blocked drainage ditches.

Cause: - Either side of the road there should be a drain which takes surface water off and away from the road down mitre drains at intervals along its length. When these drains become blocked with mud or vegetation the water can not flow away and this will damage the road.

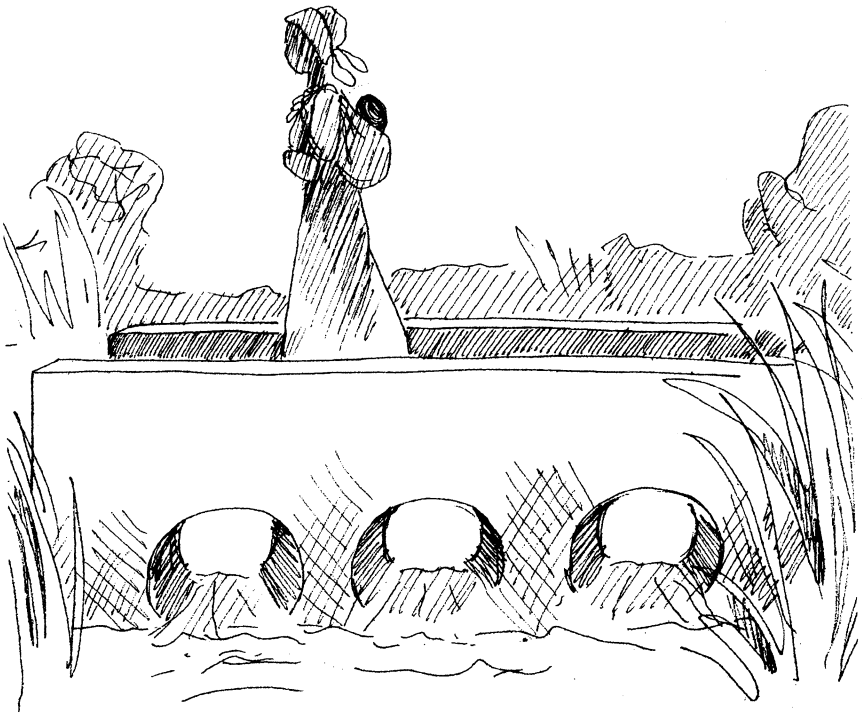


Solution: Maintain the ditches by the road, by keeping them free of mud debris and grass, especially just before the rainy season.

CULVERTS

Problem: Flooding.

Cause: Culverts allow water to pass under the road and may become blocked with mud or vegetation, causing rain water run off to back up against the culvert, flooding the surrounding area and sometimes even the road.



Solution: Maintain the culverts under the road, by keeping the approach to the culverts and the pipes free of mud debris and grass, especially just before the rainy season.

TOOLS

These are the main tools needed for building and maintenance. It will not always be possible to have a complete set, but the more tools available the easier it will be to maintain and repair quickly.

BUILDING

Cold chisel 25mm
Lump hammer
Brick hammer
Spirit level 1.2m long
Building line
Brick trowel
Plaster trowel
Pointing trowel
Wood float
Steel float
Steel square
5m Tape measure
Inside corner
Outside corner
Wheelbarrow
Shovel
Pick axe
Bucket
Steel dindo or tamp
Plumb

PLUMBING

Pipe wrench
Adjustable spanner
Set of open-ended spanners
Pliers
Hacksaw
Rasp or file
Tin snips
Soldering iron
Cold chisel
3m Tape measure
PTFE tape
Tap and die tools

ELECTRICAL

Set of screw drivers
Pliers
Side cutters
Hacksaw
Claw hammer
3m Tape
Wood drill
Reamer

EXTERNAL & ROADS

Wheel barrow
Shovel
Pick axe
Hoe
Bucket
Rake
Slasher
Bow saw
Stiff broom

CARPENTRY & ROOFING

Claw hammer
Wood plane
Hand saw
Tennon saw
Wood chisels 6, 12, 20, and 25mm
Set of screwdrivers
3m Tape measure
Steel square
Spirit level
Glass cutter

IMPORTANCE OF TOOLS

With out the right tools, you will not be able to carry out maintenance and repairs.
With the right tools available, you will be able to maintain and repair.

CARE AND STORAGE OF TOOLS

These tools are for the maintenance of your buildings and surroundings, and must therefore, be looked after carefully and stored away safely when not in use, and be recorded on a tools inventory list.
Any tools with moving parts, wheel barrows, clamps and braces, etc. should be cleaned and oiled before being stored away. All hand tools must be cleaned and stored neatly, preferably hanging up on marked hooks on the wall.
This way you will see the tools that are out or missing easily.

A special tool store with a sturdy door and padlock is the best security, overseen by a maintenance committee member who alone would be responsible for the care and safety of the tools.

MAINTENANCE TROUBLE SHOOTING CHECK LIST

ITEM	PROBLEM	CAUSE	SOLUTION
Foundations	subsidence	inadequate foundations poor drainage	underpinning : seek advice from a technical expert
Trees and roots	cracks in walls	roots under building	cut back roots
	damaged sewers	roots pushing pipes	build cut off wall
Drainage	local flooding	poor drainage	improve drainage
Storm water drainage	flooding	blockage	keep the drains clean rod the drains
Gutters and down pipes	leaking	age, damage	repair leaks with solder or
	overflowing	blocked	silicone clean regularly
Gates	hinges and latches broken	age, wear and tear	repair or replace fittings
	peeling paint	age, wear and tear	repaint
Refuse collection	poor collection and disposal	poor system	provide drums, collect and dispose of regularly
Floor screed	cracks	poor cement sand mix	hack out and re-screed
	de-bonding	poor preparation	hack out and re-screed
PVC tiles	cracks	age, wear and tear	replace tiles
	de-bonding	excessive water when cleaning	replace tiles

ITEM	PROBLEM	CAUSE	SOLUTION
Concrete floor	cracks	shrinkage	hack out and repair
	potholes	poor concrete mix	hack out and repair
Foundation walls	moisture	poor drainage	improve drainage
	erosion	poor drainage	replace soil
	plaster cracks	shrinkage	hack out and re-plaster
Face brick and block	weak mortar joints	weathering	rake out and re-point
Plastered walls	cracks	shrinkage	hack out and re-plaster
	plaster spalling	poor plaster mix	hack out and re-plaster
D.P.C.	rising damp	inadequate D.P.C.	install new D.P.C.
Ant guards	ants and termite damage	no ant guard	install ant guard
		no ant poison	apply ant poison
Painting	dirty	wear and tear	clean and touch up
	peeling	moisture penetration	strip and repaint
Subsidence	severe cracks	foundation subsidence	underpinning : seek advice from a technical expert
Ceiling battens	sagging	age or rot	replace damaged battens
Ceiling board	sagging	leaking roof	repair roof and replace boards

ITEM	PROBLEM	CAUSE	SOLUTION
Roof trusses	sagging	poor construction	jack up the truss and
		damaged timbers	strengthen the joints
			cut out and replace the damage
Purlins	sagging roof sheets	sagging purlins	replace affected purlins
Roof sheets	leaking	cracked	remove and replace sheets
		age	remove and replace sheets
		failed washers	new washers or silicone
Termites	termites	no ant guard	install ant guard
		untreated timbers	treat timbers
Gutters	blocked	leaves and debris	clean regularly
	leaking	failed joints	re-solder joints
Flashing	leaking	poor construction	refit the flashing
		age	replace the flashing
Fascia	loose	failed fixings	new fixings
	rotten	damp rot or termite attack	replace fascia
Doors	rotten	weathering or termite attack	replace the door
	damaged	wear and tear, vandalism	replace hinges and locks
Window stays and Handles	loose	fittings not tightened	tighten screws
	broken	wear and tear, poor quality	replace fittings
	missing	vandalism	replace fittings

ITEM	PROBLEM	CAUSE	SOLUTION
Locks and hinges	loose	fittings not tightened	tighten screws
	broken	wear and tear, poor quality	replace fittings
	missing	vandalism	replace fittings
Glazing	broken	vandalism	replace glazing
	dirty	wear and tear	clean regularly
Burglar bars	loose	wear and tear	remove and re-fix
	rusty	age	sand and repaint
Pipe reticulation	leaks	wear and tear	repair the leaks
			replace the pipe or fitting if necessary
Taps and valves	leaks	wear and tear	replace washers
			replace fitting if necessary
Basins	full of dirty water	blocked	clear with plunger
	leaking waste	failed seal	replace seal
Showers	missing rose	vandalism	replace rose
	leaky taps	failed washers	replace washers
	blocked waste	poor cleaning	clean regularly
Toilet bowls	blocked	inadequate flushing, debris	rod the system
	leaking	failed connection to sewers	re-mortar pipe connection
	not flushing	cistern broken, no water	repair cistern or water supply
	foul smelling	poor cleaning and sanitation	clean and disinfect regularly
Toilet cisterns	not flushing	broken handle or no water	repair or replace handle
	over flowing	ball valve broken or stuck	replace ball float or valve

ITEM	PROBLEM	CAUSE	SOLUTION
Over head tanks	leaking	age	repair or replace tank
	over flowing	stuck valve	repair valve
Bore holes and electrical pumps	dry hole	low water table, high use	deepen the hole
	muddy water	wall collapse, pump too low	raise the pump
	break down	wear and tear	raise the pump and repair
Stand pipes	broken or missing taps	wear and tear, vandalism	repair pipes, replace tap
	dirty	poor hygiene	clean regularly
wells and windlasses	contamination	debris thrown into the well	check and clean the well
	missing chains and buckets	vandalism, wear and tear	replace chain and bucket
	dirty	poor hygiene	clean regularly
Hand pumps	not pumping	pump valve worn	raise pump and replace valve
	dirty	poor hygiene	clean regularly
Manholes	blockage	heavy use and debris	clean and rod
Gullies and traps	blockage	wind blown debris	clear out the trap often
Septic tanks	full and overflowing	heavy use and age	remove sludge and flush out
Soakaway	overflowing	blockage with sludge	clean or build a new one
Switches and sockets	broken	wear and tear	replace fitting
	loose	wear and tear	re-fix
	not working	wear and tear	replace fitting
Wiring and conduits	faulty wiring	poor connections, age	call the electrician
	loose conduits	poor fixing	call the electrician

ITEM	PROBLEM	CAUSE	SOLUTION
MCB	breakers tripping	wires shorting out	call the electrician
Light sockets and bulbs	blown bulbs	wear and tear, poor quality	replace the bulb
	damaged holders	Wear and tear, age	call the electrician
Solar power	dirty panel	wind blown dust	clean the panel regularly
	poor battery	age	replace the battery
Blackboards	poor surface	wear and tear, poor paint	repaint
	loose board	screws loose	tighten screws
Gravel and earth roads	potholes	wear and tear, standing water	fill and compact
	wheel ruts	wear and tear	fill and compact
	corrugations	poor drainage	re-grade
	loss of shape	poor drainage	re-grade
Tarmac	potholes	wear and tear	cut back and patch
Drainage	standing water	blocked drains	clean regularly

GLOSSARY OF TECHNICAL TERMS

A/C sheet	asbestos cement roofing sheet
Acrow prop	adjustable steel pipe support
Adhesive	glue
Ant guard	galvanized steel sheet between the slab and wall protruding out to stop ants and termites climbing up
Ball float	plastic ball that acts as a float in the toilet cistern
Ball valve	valve opened and closed by the ball float
Batch box	300x300x300 box with lifting handles to measure sand, stone and cement when making concrete
Battens	38x50 or 50x50 soft wood timbers to support the roof tiles or sheets
Bituminous paint	paint made from bitumen or tar base used for sealing roofs or floors
Bore hole	hole sunk by a boring rig for water to be pumped from
Brandering	38x50 or 50x50 soft wood timbers to support the ceiling
Breaker	electrical switch fuse
Camber	slope across a road
Capillary action	action that causes water to climb up walls
Carbolinium	manufacturers name for timber preservative
Cement	powder supplied in bags used for making concrete
Cistern	water holding tank used for flushing toilets
Concrete	mix of water with cement, sand and stone to make solid floors
Conduit	plastic pipe to protect or hide and carry wires from one place to another
Corrugation	rough lines or bumps across a gravel road
Course	one line of bricks or blocks

Cover strips	thin timber strips to cover the joints between ceiling boards
Creosote	timber preservative
Curing	Keeping concrete covered and damp to help the hardening of concrete
D.B.	distribution board where electrical wires are controlled from in the building
D.P.M.	damp proof course which is a felt sheet laid under the wall to stop damp rising
Damp rot	rot in timber caused by the timber being damp
Dish drain	outside drain dished in shape to take water away from the building
Down pipe	pipe connected to the gutter to take water from the gutter to the dish drain
Dwarf wall	low wall
Erosion	soil being washed away
Erosion gullies	gullies washed into the side of the road by water washing soil away
Face brick	special brick with a smooth finish used without plaster
Fascia board	thin timber board fixed at the end of the roof sheet for appearance, or to fix the gutter to
Fiber-glass	stiff plastic sheet made from resin and fiber used for making water tanks
Flashing	galvanized steel sheet to prevent water getting between the roof sheets and the wall
Floating coat	coat of plaster finished with a steel or timber float
Fluorescent tube	electrical light in a tube fitting
Foundations	thick concrete strip cast in the ground to construct a building off
Fuse	safety device usually in a plugs to protect electrical fittings
Galvanized iron	material used to make roof sheets
Gasket	felt or rubber seal in taps or valves

Gloss	oil based paint with a smooth shiny finish
Gauge box	300x300x300 box with lifting handles to measure sand, stone and cement when making concrete
Gully	trap to control water flow into the drain pipes and trap leaves and debris
Gutter	channel fixed to the roof sheets to trap and carry rain water to the down pipes
Hairline crack	very thin crack
Incinerator	devise for burning rubbish safely
Jack up	raise up by using a jack or acrow prop
Laterite	reddish brown gravel with sandy clay common in Zambia
M.C.B.	miniature circuit breaker found in the electrical distribution board used to turn the electricity on and off
Man hole	brick built chamber in the ground, usually where sewer pipes meet or change direction
Mortar	cement and sand mix used for laying blocks and bricks
Mortise lock	type of key operated lock found with a door handle
P.T.F.E. tape	thin plastic tape used to help seal pipe connections
P.V.A. paint	water based paint with a mat finish
P.V.C. tile	plastic floor tile glued in place
Plaster	cement and sand mix used for covering a block wall and finishing it smooth to take paint
Porous	material that consists of an open texture that allows water through, in other words not water proof
Pothole	hole in the road caused by wear and tear or poor drainage
Preservative	treatment to preserve and protect against termite and water damage
Primer	first paint coat to help the finishing paint adhere to the plaster, steel c. wood

Purlins	50x75 soft wood timbers to support the roof sheets
Putty	soft oil based clay putty used to fix glass window panes into the window frame
Rake out	action of chiseling out mortar between bricks
Re-point	re-forming the joint between bricks
Refuse	rubbish or waste
Roofing compound	special thick paint usually bituminous, used to seal leaks in roof sheets
Rubber plunger	rubber cup on a stick used to clear blockages in the sink
Rust	steel rot caused by moisture on unpainted steel
Screed	cement and sand mix used to finish concrete floors level and true
Sealing paste	special paste made to seal pipe connections
Septic tank	under ground block tank to hold waste water and sewerage
Sewer pipes	underground pipes to carry waste water and sewerage
Shower rose	shower fitting to make water spray out of the pipe in a spray
Shrinkage	contraction of concrete or plaster as it dries
Sieve	steel mesh to pass sand through to clean out vegetation and large stones
Silicone	special plastic sealant which comes in a tube and hardens in contact with the air
Slab	concrete floor
Sludge	sewerage waste water and solids left in the septic tank
Slurry	thin mix of cement and water
Soak away	large pit filled with stones and rubble after the septic tank which allows water to soak into the ground
Socket	electrical fitting in the wall to take electric plugs
Solar panel	special panel used to make electricity from sunlight

Solder	similar to welding but by using soft wire and heat
Spalling	crumbling off
Spatula	flat plastic trowel used for applying glue
Spindle	steel rod that spins round to open and close a tap
Splice	connection between two pieces of wood between supports
Stand pipe	pipe rising out of the ground with a tap on the end
Steel channel	steel section shaped like a channel [
Steel float	flat square steel trowel used to finish concrete, screeds or plaster smooth
Stop cock	pipe valve to turn water on and off
Storm water	rain water that runs off the roof and roads into the drains
Straight edge	straight length of steel or wood used to finish wet screed or plaster straight and true
Striking plate	flat steel plate fixed to the door frame for the lock to strike against
Subsidence	natural ground shrinking or collapsing due to the weight of a building above
Switch	electrical fitting in the wall to turn lights on and off
Tamp	heavy weight with a flat end on a long pipe to compact soil and screeds
Tarmac	bitumen and gravel mix finish for roads
Termites	ground burrowing insects that feed on wood and attack timber doors and roofs
Thread tape	thin plastic tape used to help seal pipe connections
Underpinning	strengthening of foundations
Valley lining	flat steel sheet between roof valleys which acts like a gutter to control rain water run off
Valve	device that allows taps to open and close

Vent pipe	vertical pipe that allows foul air from the sewer to escape at a high level
Washers	felt or rubber seal in taps or valves
Waste pipe	pipe that takes sewerage waste with water from the toilet into the sewer pipes
Waste trap	gully with a cover to prevent debris washing into the sewers from sinks and showers
Wheel rut	groove formed in the gravel road by car wheels
Windlass	wood or steel pole that supports the chain and bucket for a well
Window stay	steel bar that keeps a window open
Wood float	flat square wooden trowel used to finish concrete, screeds or plaster smooth