5.0 DESIGN TECHNIQUES

This section deals with the techniques and materials needed for design from the first step of collecting basic information right through to the documentation of the final design.

5.1 BASIC TOOLS, EQUIPMENT AND MATERIALS

The designer needs plenty of space to pin up sketches on a wall or pinboard, some large flat surfaces, good light, access to a photocopier and a good quality camera. Access to a colour laser photocopier and computer aided design facilities make full fledged professional plans possible to a high standard of presentation and accuracy in a shorter time. However, design can be managed without the latter.

The basic materials of design are panoramic photographs, aerial photographs, contour maps, forest cover maps etc. and photocopies of much of this in both colour and black and white. In addition, computer generated terrain models or 3D contour models can be used if the appropriate facilities exist.

Finally, a selection of felt tip pens, pencils, crayons, tracing paper, acetate sheets and the usual office supplies should be available.

5.2 VISUAL LANDSCAPE INVENTORY AND ANALYSIS

The visual inventory of the landscape is the first main task undertaken by the designer. The step-by-step approach is presented in Chapter 11 of the Recreation Manual. This involves checking the visibility of the area, rating the different factors of the landscape that is, visual sensitivity, visual absorption capability and existing visual condition. A basic analysis of the above factors helps establish recommended visual quality objectives.

5.3 SELECTING VIEWPOINTS

It is useful to make a distinction between designated viewpoints such as those public ones where the scenery is ‘consumed’ and those which help the designer to see the landscape fully and understand how it is put together. It is best to find a wide number of viewpoints, both ‘public’ and ‘designer’ and to select from amongst them the best for design and presentation purposes. Designer’s viewpoints may be obtained by climbing up a hillside to a rock outcrop where the view opens out to some degree or where obscuring foreground vegetation can be avoided. Oblique aerial views from a helicopter will also help to see into hidden areas where it is easier to understand how the landform is structured and to provide transitional viewpoints between the level views and vertical aerial photographs. This will help enormously when transferring the design from perspective to plan.

5.4 PHOTOGRAPHY

The object of landscape survey photography is to show as much detail of the landscape as possible, especially topography, rather than to create artistic compositions or record interesting lighting conditions.

The most appropriate camera is a 35 mm single lens reflex with through-the-lens metering. Models with manual setting of exposure and shutter are better than automatic cameras since landscape needs accurate exposure which has not been distorted by light from the sky.
A standard 50 mm focal length lens is adequate, and a 70-210 mm zoom is useful for close up detail at greater distances. Use a tripod, convenient stump, fence post or the car roof to steady the camera for zoom shots, in low light conditions or strong winds. A wide angle lens is useful for single frame views but not for panoramas since the distortion is too great. Polarizing, skylight or ultra-violet filters help to cut down interference from atmospheric haze and improve contrasts.

Modern compact cameras are improving, especially those which meter the exposure in a balanced view of the landscape rather than on average where the landform tends to be underexposed. In good light and under front lit conditions, they produce acceptable results.

Colour print film should be used. Film speeds of 100 or 200 ASA normally permit sufficient detail to be recorded under most lighting levels. Carry a 400 ASA film in case daylight deteriorates, though the photographs may lose some detail.

It is normal that the landscape composition cannot be encompassed in a single photo frame, so a number are taken and subsequently joined into a panorama. To do this properly, an overlap of around 25 per cent is needed from one frame to the next. The format can be ‘landscape’ or ‘portrait’ depending on the depth of the scene. Ensure that sky right down to foreground is included and that the extreme ends of the panorama encompass scenery outside the design area. It is very frustrating to find a vital piece of the scene cut off the view to save film!

Since film and processing are relatively cheap compared with staff time, it is better to photograph as many views as possible rather than find that a vital section is missed requiring a return trip. Be very conscientious and record the exact location of all ground based photographs together with their direction, date and focal length used. As soon as the photos are developed and panoramas spliced together, check which views are which, number them on the reverse and on the map. Lay them all out on table and select the best ones for design purposes. Ensure that each view overlaps in its coverage with its neighbour, which is important for transferring the design from one view to another. Select one or two of any higher elevation shots as the ‘coordinating’ views where the design from 2 or 3 more detailed views can be blended together.

Preparing a panorama:

Identify area of overlap and the portion which gives the best coincidence of features of the landscape.

Cut the first print with a sharp knife or scalpel within the limits of overlap where there is a good match of line and colour.
Overlap that print accurately on its neighbour, and tape temporarily and securely in position.

Remove surplus, butt accurately in position, and tape temporarily on the front of prints. Then tape the join permanently on the back, rubbing down for good adhesion.

Cut through both prints close to the first cut. Press hard on the straight edge to ensure that the prints stay in position once the tape is cut.

Repeat for subsequent frames and trim edges of completed panorama top and bottom.

Panoramas can be taken adequately with a hand-held camera - plant the legs wide apart, clamp the upper arms tightly to the chest and swing the upper body round on the hips while advancing film after each shot without taking the camera away from the eye. If conditions risk a poor result then use a tripod.

Exposure is set on that part of the landscape away from the sky and of comparable tone to the subject of the view. This avoids under-exposure of the fore - or middle-ground. Weather, quality of light and direction of the sun affect results: clean air and bright light from an overcast sky are ideal. Bright sunshine can give too much contrast and loss of detail in shadows, though this is less serious when the landscape is front or top lit. Patchy cloud affects exposure, particularly of panoramic composites, hiding detail as it passes across the view. Avoid hazy or misty conditions, especially for long distance views.

The photos should be enlarged to a minimum of 5"x7" or larger for design purposes and to give a better feel for the landscape as one might actually see it in the field.
5.5 USING THE PHOTOGRAPHS

Having obtained the photos and selected the sample to design from, they can be used in several ways. Never draw directly on to the prints or they will be spoiled.

a. Cover the photographs with a sheet of acetate and use this to design on. Use pens suitable for acetate but which can be wiped off so that changes can be made to the design. Acetate can be found in a range of weights. The lightest tend to cling to the hand with static so medium weights are recommended. Rolls are available so that panoramic photos can be covered with a single piece. Secure the acetate with drafting tape to the rear of the photo. The photos and their overlay should be kept flat, loosely rolled or hung up by their ends.

b. For reproduction purposes, or to provide a design base, a sketch can be made from the photographs on an acetate overlay. A permanent fine point marker should be used. The sketch is basically a tracing of all the relevant detail in line form from the photo. No artistic talent is required. The result can be photocopied and used for basic analysis and design or for presenting solutions.

A simple base sketch made by tracing over a photograph.

c. The design or analysis drawings on acetate can be photocopied together with the photo so that the two appear together. This saves work for presentation purposes.

d. The photograph can be photocopied in colour or monochrome half-tone. For this to be successful, the photograph needs to be of good quality, taken on a bright day so that there are a wide range of tonal ranges. The photocopier must be capable of handling half-tones. The average office copier is not satisfactory but up to date laser copiers produce excellent results. Colour copies are useful for display purposes but monochrome half tones are better for both design and presentation of analysis and design options. The background detail of the landscape is present yet the information in the analysis or design stands out more obviously. As well as the quality of their reproduction, laser copiers are good at enlarging or reducing photographs, thus saving processing costs. It is also useful to be able to enlarge the design sketches for exhibition purposes or reduce them to fit into folders or binders for documentation.

5.5.1 AERIAL PHOTOGRAPHY

Vertical aerial photographs are very useful for design either used in their usual stereoscopic pairs or as orthophotos, especially for translating the design from elevation into map form. If possible the photos should be at the same scale as the maps. If they are not, it is possible to enlarge or reduce them using a process camera or a laser photocopier although at the risk of a loss of quality.

Stereoscopic pairs emphasise landform and can help pick out subtleties more easily, although they exaggerate features to some degree. Vegetation and other patterns may be more obvious than on maps and can be related to those visible on the panoramic photos. Orthophotos are extremely useful because they can virtually be used as maps and speed up the mapping process (see below). Colour aerial photos are more useful in even textured, monotonous landscapes where the subtleties of colour change may be the only feature which can be identified on both plan and perspective.
Oblique aerial photographs, perhaps taken from a helicopter, are also very useful. They help as an intermediate step in the conversion from perspective to plan. They also make more of the landscape visible so that the design can be resolved more easily in complex landforms.

5.6 MAPS

Maps are, of course, a major tool for forest planning. For design purposes they are needed in two ways: as inventory, to show basic information, and as the document which records the intentions of design for implementation. Contour maps are particularly important for visual force analysis. All information should be presented at the same scale. It may be useful to colour some maps to help to express the patterns and to help to see what relates to the photos. If the inventory is held on a Geographic Information System (GIS) then this is ideal for obtaining the relevant information or combination of different information at the right scale.

5.7 COMPUTER GENERATED IMAGES

Three dimensional, digital terrain models (DTMs) and video images can be useful in several ways. If a GIS is available with a DTM then some of the planimetric data can be draped over it to help the analysis and subsequent mapping, and to visualize different design options especially if the DTM can be projected from the same viewpoints used for taking photographs. Adding visual force lines to the DTM will assist interpretation and provide a base for comparison with map and photography.

A digital terrain model overlaid with a visual force analysis.

5.8 TOPOGRAPHIC MODELS

Topographic models are an alternative to the DTM. Layers of card of styrofoam are cut for each contour level and built up to form a 3D model of the landform. They can be useful in very complex topography to help work out the intersection of the design from different viewpoints. They are time consuming to prepare but can be useful design aids and are very good for public presentations. Storage and transport of large models may be a problem.

5.9 DESIGN METHODS

Once the photos, sketches and analysis documents are assembled and the objectives of the project are clear, then design can begin. Use tracing paper overlays and pencils on top of the analytical photo-sketches, or photo montages, and also overlay the landform analysis which should have been done on a transparency. Try out lots of sketches in pencil to test shapes and options. This helps to focus the mind and to generate ideas. This is the creative stage. Here are some helpful hints on how to make the most of the design stage.
- It is all too easy to be put off by the blank tracing paper so do not be tempted to get into too much detail at first. Sit and ponder for a while, trying to discern what it is that the analysis is telling you. Try to understand how the landscape can be broken down into different parts. Start by roughly indicating their scale, position and general shape. Check if they will answer the requirements and objectives set for the planning area. Mountain top caps or valley features often stand out at first and are easy to design. Make full use of the character analysis and be responsible to the hierarchy of visual forces.

- Once the basic shapes begin to emerge, their detail can be refined. Try to hold the pencil flexibly, using it freely with plenty of wrist action. This will ensure flowing, rhytmical shapes working with the landform. If the tracing paper gets too messy, put another sheet on top, reine and retrace the best of the design. Then discard the first tracing and work on the second. Repeat this as many times as necessary.

- Once the shapes settle down, test them against the constraints and opportunities analysis. This is where the iteration of the initial, creatively produced design into practical solutions begins. It is also useful at this stage to test out how the landscape might change over time, using simple sketches. The basic shapes may have to be re-sized to meet the VQO's set for the planning area.

- The process is repeated for each view at each stage to ensure continuity in the development of the design. Eventually, the stage of refining shapes, eliminating symmetry and other visual problems will be reached. A final, definitive tracing should be produced for each view and all the rest discarded.

- Along the way there might be times when the solution is painfully slow to come. Take a break; put the design away overnight; ask someone else for an opinion. It is often better to pause, put the sketches on the wall and stand back to look at them. A different view is obtained.

- Once the pattern of shapes is finished decisions need to be taken on their future management. Some will be destined for logging; others will form part of a forest ecosystem network. General ideas on phasing will also be needed and tested against the long term management objectives. At the same time the pattern of shapes should be transferred onto a map for further evaluation, measurement, and field implementation.

5.10 MAPPING THE DESIGN

Mapping the design in plan from perspective views is perhaps the most difficult and, in many ways, the most important stage. If the mapping is inaccurate then setting out on the ground will be wrong and the end result will not look like how it was designed nor how it was promoted to the public or other consultees. In fact, if the design has developed with constant reference back to analyses in plan then mapping will be much easier.

Unless a computer is available to accept inputs in perspective and converting them into plan, the job has to be done manually. The materials needed are the perspective photographs overlaid with the refined pattern of shapes on an acetate sheet, a vertical aerial photograph as near the map scale as possible, or better, an orthophoto, and a base map showing sufficient detail that fixed reference points can be found. The more features on the map the better - stand types where these are visible on the aerial photos, rocks, streams, roads, old clear cut boundaries, any feature that can be related from perspective to plan should be used. Oblique aerial or high elevation (for example, taken from a mountain top) photos if available are very helpful.

Step 1. Plot the outlines from the perspective to the aerial photo. Lay on acetate sheet over the aerial photo and use water soluble markers. Start by identifying a unit boundary where it relates to fixed identifiable features and interpolate the shape as accurately as possible in between.

- Do not be too worried if the mapped shape appears quite distorted compared with the perspective. This is normal in many landscapes because of the effect of the 3D landform.
Step 2. Once the overlay on the aerial photo is complete transfer it to the map. The shapes will change slightly as the distortion between aerial photo and map is accounted for. Finally, number each shape on the perspective overlay and map so that there is no confusion later on.

- If an orthophoto is available, then the two steps described above are conveniently combined in one. If oblique aerial or high elevation photos were used, the process should be faster and no guesswork will be needed to interpret shapes that go into 'dead ground' from the design viewpoints.

The mapping process may look like the final act, carried out separately from design. However, ideally a provisional map should be prepared at the stage when it is needed to allow proper review and evaluation of the design. It will be revised as the design is refined and developed. The final map agreed upon should be labelled as such, interim versions being destroyed to avoid future confusion.

If a GIS is available with a DTM capability the accuracy of the map can be checked. The mapped shapes should be digitized as a layer in the GIS, draped over the DTM and viewed from the same points as the design photos. The shapes can be compared and adjustments made to the map back and forth until the desired results are achieved in perspective.

5.11 ILLUSTRATING THE DESIGN

For communicating the intention of the design, it must be illustrated from the main viewpoints in such a way that those who need to understand it can do so easily. The design may well be presented to people who are not familiar with maps and plans, and for whom the visual impression will be how they judge the result once implemented. If the final sketches are presented with the analyses then the logic and reasoning behind the design should be crystal clear.

The drawings should be as accurate and realistic as possible. If the activities carried out on the ground look exactly like or are very close to the agreed design then credibility in the process can be built up.

There is a range of techniques for illustrating designs to suit all levels of skill and budget, from simple sketches based on tracings to computer and video images. Bear in mind that simple sketches well done can be very persuasive and are also cheap. Some of the most sophisticated computer graphics take longer to produce than a simple sketch and may be no more informative. Here are some methods which are tried and tested. Most use one of the base drawings described above.

1. Tracing from perspective photographs. For this, the base sketch is prepared as described, and the outlines of the block shapes are traced out to a copy. If an area is to be shown felled, then tree height is projected downwards from the outline and the revealed edge is illustrated. Trees to be left standing within the unit can be shown afterwards. Pencil crayons or felt-tips can be used to fill in the texture of the standing forest, the felled edge can be shown realistically as can ground texture. Shadows add the final touch of three dimensions. Tree height can be gauged from other edges nearby.
If a skyline is involved, care is needed to depict what will be revealed when the trees are cut. Draw the forest texture in carefully so as not to spoil the final effect. If the drawing is displayed next to the original photograph and analysis, the effect can be very good. Subsequent drawings can be used to show the progress over time, depicting green up and growth stages using different textures. In this way, the whole forest cycle can be shown at regular intervals.

2. Photocopies of photographs. A colour or black and white half-tone photocopy is used in the same way as described above. The tree height is projected downwards as before, but to show the area as felled, the standing forest must be covered up. This is easily done with a soft, opaque, white pencil crayon. Skylines are lowered using typing correction fluid. Once again, edges, ground texture, standing trees and other apparent features can be drawn in. The rest of the photocopy is then coloured, leaving the background and non-forest parts of the landscape monochrome. If the forest texture photocopies well, then a wash of colour is all that is needed as the trees will show through.

A half tone photocopy with the unit shape shown at canopy height.

The extent of tree height is deduced and the ground level marked in. Tree texture is erased and coloured white in the felled area.

The revealed tree trunks are drawn in, some ground texture and shadows added and the sky restored where the trees are felled away from the skyline.
3. Computer rendering. With this technique the landform and forest are shown as a wireframe image. The felled area can be shown as a hole in the canopy, or with trees along its perimeter. The image is used as a base for pencil crayon or felt-tip graphics to be rendered on top. This method has the advantage of accuracy of tree heights and perspective. It may have more credibility because it is based on computer output. Some systems are able to depict the felled areas in brown while the rest of the forest is shown as a bland green. These images are not cheap nor do they come up to the standards even of simple sketches. They lose textures and other details from the surrounding forest and at the moment are unable to show partial or shelterwood logging. The development of computer rendering is likely to proceed quickly so that in the near future much more realistic results may be obtainable, possibly showing growth and seasonal changes.

A computer image showing landform and a pattern of shapes. This could be used as a sketch base for graphics.

4. Video images and computer graphics. Programs are available to take a photograph and modify it to show the effects of design. Either the photo is video-recorded or scanned into a computer. Real forest textures from elsewhere on the photo or from a file can be used to fill felled areas with the appearance of a logged site or a recently greened up effect. These methods can be expensive and relatively slow, but highly realistic.

A video image showing the realistic effect of two proposed units.
5.12 CUT BLOCK LAYOUT

1. Ground surveying.

Start with any known points that can be identified along the boundary to be marked. From these other points can be located by taking a compass bearing and foot pacing or chain to the point. This works relatively easily in open stands but not in dense or rocky places where walking is impossible.

This method can be checked in two ways. One is to let logging proceed (the most critical need to get accurate shapes is when clear cutting is to take place) and to check progress as it nears the marked edge by visiting the viewpoints with the sketches to see if the emerging shape is accurate. Adjustment can be made on the ground by stopping or extending logging. Checks on the compass bearing can be made once the area opens and walking or sight lines are possible.

The second way of checking is by using helium filled balloons on long lines. Someone with binoculars and a radio sits at a viewpoint (one of the ‘designers’ viewpoints is best) and gives instructions by radio to the person holding the balloon which is allowed to float up through the canopy to mark the point where the boundary is supposed to be. Adjustments can be made until the right point is reached. This works if the canopy is light enough to allow a balloon through. Small balloons are not too visible over long distances even with binoculars so the method is limited. Wind is also a limiting factor.

2. Global positioning systems.

These are not fully tested, but when they work properly, they could allow a large number of points to be marked around a boundary with complete accuracy. This method uses sailing navigation systems which compute the exact position of a probable unit from signals provided by satellite. At the moment the accuracy is not 100 per cent due to military requirements but to 15-30 m of the accurate point which may be enough in many areas. There is also doubt about the strength of reception beneath the forest canopy unless long aerials or booster stations are available. Although the method needs more work, and is constantly evolving, it holds much promise and is used more and more in certain parts of British Columbia.

3. Block layout.

A plan of the road system is laid over the unit outline and right angle offsets or bearings marked at standard (50-100 m) intervals along it. Measurements are recorded of the distances from road to the unit boundary. The logging is allowed to take place and its progress checked along each offset or bearing once it approaches the boundary. Visual corrections from viewpoints can also be made. This method is best in the most difficult topography where ground surveying is impossible.

A variant on this theme is to mark a plan with the maximum distances of extraction by different machines from the road to geometric shapes within the boundaries. These areas are felled enabling extensions by offset or bearing to be made for extraction by another means, for example helicopter.
Basic unit layout.

Method one:

1. Locate known points from map/aerial photo.

2. Find other points by compass bearing from these features.

This method works in open stands in reasonable terrain.

Method Two:

1. Using an existing or new road set out regular intervals.

2. As logging proceeds allow fellers to work up to set distance from road.

3. Keep a check on progress as the logging nears the set distance.

4. For corners work either at right angles to the felled edge or set another line and work up and down from it.