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Survey Section. Works & Supply -
Boroko,

DEPARTMENT OF WORKS

STANDARD SURVEY INSTRUCTIONS

Amended to July 1985

Date ___/___/___

No. _____

DEPARTMENT OF WORKS

STANDARD SURVEY INSTRUCTIONS

These Instructions are issued as a guide to both Consultants and Departmental Officers engaged in carrying out survey work for the Department.

All surveys and submissions connected therewith are to be carried out strictly in accordance with these Instructions and such amendments thereof as may be issued from time to time. This applies even though the survey may only form part of an overall brief.

Emphasis must be placed on the major factors of adequate control, re-instatement of survey and overall accuracy within specified limits.

The primary intention of these Instructions is to standardise surveys, but it is anticipated that rigid adherence thereto will enable engineering surveys to be utilised in fulfilling the Department's obligations under the Survey Co-ordi-nation Ordinance.

J. BAURE
Secretary

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SECTION 1

DEFINITIONS OF TERMS

1.1 BENCH MARK

Shall mean a Standard Bench Mark being a surveyed point consisting of:

1.1.1 A bench on a blazed tree of not less than 600 mm diameter as detailed in Appendix A.

1.1.2 Or a drill hole in solid rock or concrete 10 mm diameter, 25 mm deep, surrounded by a chiselled triangle of 150 mm sides.

1.1.3 Or a galvanised pipe in concrete of similar nature to a Permanent Recovery Mark as described in part 1.6.1.

Provided that, where the mark is other than a tree, the indicator shall be a star picket or a length of 25 mm waterpipe, projecting at least 500 mm above the ground

Sufficient measured ties from the B.M. to permanent features are to be obtained, to assist in relocation of the of the mark.

Bench Marks on trees shall not be used in urban areas.

Where directed, the Bench Mark Data form (see Appendix I) shall be completed and returned to the Department. (See also the note at the end of this Section).

1.1.4 Or a permanent Survey Mark.

1.2 CENTRELINE MARK

Where in these instructions the centreline is to be marked, the mark shall consist of:

1.2.1 A 50 mm x 50 mm sawn hardwood peg 250 mm long, pointed at one end and driven flush with the ground, the top to be painted white, together with an indicator consisting of a sawn hardwood peg 50 mm x 20 mm x 750 mm long in urban areas and 500 mm long elsewhere, painted white and driven firmly in the ground about 150 mm behind the peg or mark when viewed along the chainage, or on the side remote from the centreline in the case of offset marks.

1.2.2 Or an iron spike 250 mm long driven flush with the ground.

1.2.3 Or a drill hole in solid rock or concrete, 10 mm diameter and 25 mm deep, together with a 250 mm square, painted white, in a prominent position adjacent to the mark.

1.2.4 On bridge spike on existing formation.

1.2.5 Relative chainage and description of the mark shall be painted or stencilled on the indicator. In the case of offset and recovery marks, the offset distance is to be shown on the back of the indicator or below the chainage in the case of painted squares on rock etc.

1.3 THE DEPARTMENT

Shall in all cases refer to the Department of Works & Supply of Papua New Guinea.

1.4 THE SECRETARY

Shall in all cases refer to the Secretary of the Department of Works & Supply of Papua New Guinea.

1.5 OFFSET CENTRELINE MARK

Shall mean a mark placed at a known distance from a centreline when it is not practical to mark the true centreline.

1.6 PERMANENT RECOVERY MARK

1.6.1 Shall be a galvanised iron pipe set in concrete, the dimensions of which are shown in Appendix A, located generally as in part 1.8 below or as directed. The exact location and description of such marks in relation to the survey, together with a level reduced to the survey datum shall be recorded for such marks on the survey plan in all cases.

Sufficient measured ties from the PRM to permanent features are to be obtained, to assist in the relocation of the mark.

1.6.2 Or where a pipe cannot be placed owing to the nature of the ground, a drill hole and wing, or spike as described in part 1.2 above may be utilized instead.

1.7 PERMANENT SURVEY MARK

Shall be a Permanent Survey Mark as described in part 2.8 of the Survey Directions.

1.8 RECOVERY MARK

Shall be a mark of a nature described in part 1.2 except that in urban areas where the mark is a peg, it shall be 100 mm x 50 mm, painted white indicated as in part 1.2. Generally recovery marks shall be placed in pairs evenly disposed about and at right angles to the centreline on straights, or at $^1/_2$ angle on intersection points. On curves they shall be placed radially.

1.9 RURAL LANDS

Shall mean any land other than urban or suburban land.

1.10 SCALE OF FEES

Shall mean the Scale of Fee as laid down from time to time by the Association of Surveyors of Papua New Guinea.

1.11 PRINCIPAL SURVEYOR

Shall mean the Officer in charge of the Survey Section of the Department or any person appointed by the Secretary to carry out his duties.

1.12 SUBURBAN LANDS

Shall mean land closely subdivided outside of Gazetted town boundaries.

1.13 SURVEYOR

Shall mean a person qualified for Corporate Membership of the Association of Surveyors of Papua New Guinea.

1.14 URBAN LANDS

Shall mean land within Gazetted town boundaries.

1.15 SURVEY DIRECTIONS

Shall be the Survey Directions as laid down by the Surveyor General under Section 37, Chapter 95, the Survey Act.

NOTE Nothing in these instructions is intended to prevent the person carrying out the survey from placing such additional marks or obtaining data on points which, in his opinion, will serve as an aid in the reinstatement of any survey. Nor is it intended to preclude the use of Permanent Recovery Marks or Permanent Survey Marks placed in accordance with these instructions from serving the dual purpose of both recovery and bench marks.

In addition, Permanent Survey Marks or Bench Marks on trees may serve as Recovery Marks, provided they are placed in the position stipulated for Recovery Marks.

Should the occasion arise whereby the procedure to be adopted is not covered by these instructions, the Survey Directions shall apply.

SECTION 2

GENERAL CONDITIONS OF EMPLOYMENT OF CONSULTANTS ENGAGED ON SURVEY WORK

2.1 GENERAL

2.1.1 The commission is to be carried out strictly in accordance with these Instructions, together with any special instructions and provisions that may be included in the project Brief; and with any additional or amended instructions that may be issued by the Principal Surveyor in writing during the survey.

2.1.2 Liaison is to be maintained during the survey between the Consultant and the Principal surveyor. Recommended deviations from the instructions included in the Brief, are to be referred promptly to Departmental Headquarters so that revised instructions may be issued if necessary.

2.1.3 The Principal Surveyor may direct that checks of any work be carried out by an officer of the Department or he may instruct that the check be performed by a Consultant. If it is proved that the work is unacceptable in that:

2.1.3.1 it has not been performed in accordance with the standards or accuracy herein;

2.1.3.2 and/or marks have not been placed in accordance with these or other written instructions;

2.1.3.3 and/or in the opinion of the Secretary, the information supplied is incorrect or insufficient within the meaning of these or other written instructions; he may order such additional surveys or calculations as are deemed necessary to amend or correct such work, and any cost involved thereby shall be chargeable to the Consultant whose work was

found to be at fault. Such costs shall be negotiable, subject to the extent of errors or omissions revealed. Any such check surveys shall be performed and relevant documents signed by a Surveyor as defined in part 1.13.

2.1.4 The engagement of the Consultant may be terminated at any time. The Consultant shall be advised of the reason for such termination. In the event of termination of the engagement, payment shall be made on a proportionate basis as determined by the Secretary. All field notes, sketches, drawings or other documents, whether complete or not, shall become the property of the Department.

2.1.5 Progress reports are to be supplied monthly, or more frequently as required, together with copies of the Standard Time Sheet, which will indicate the actual type and amount of work carried out on each day by each survey party and shall show:

2.1.5.1 Surveyor's name

2.1.5.2 Date

2.1.5.3 Chainage worked, from and to

2.1.5.4 Type of work engaged in

2.1.6 The Consultant shall supply to the Principal Surveyor the following documents at the completion of the survey:

2.1.6.1 Field survey books and notes, fully documented and legible as in Section 3;

2.1.6.2 Field sketches prepared by the Consultant;

2.1.6.3 Plans issued in conjunction with the commission and any other relevant plans or documents received or obtained by the Consultant in the course of the commission;

2.1.6.4 Completed sketches of Photo Control Points, Permanent Survey Marks, Bench Marks and Road Traverse detail as specified in the relevant sectons of these Instructions.

2.1.6.5 A receipt will be issued for such documents by the Department. The issuing of such receipt, shall in no way be binding on the Department as an indication that the work therein is acceptable or not, subject to checking and correction as stipulated in these instrucions.

2.1.7 Detailed accounts (see part 2.3) must be made. Progress payments may be made at the discretion of the Principal Surveyor.

2.1.8 The Consultant shall indemnify and keep indemnified the Department of Works & Supply from and against:

2.1.8.1 All claims by an officer, employee, workman or contractor of the Consultant under the Workers' Compensation Ordinance 1958 - 1961.

2.1.8.2 All or any legal liability, claim or proceedings in respect of any injury or damage whatsoever to any property, real or personal, in so far as such injury or damage arises out of, or in the courses of, or by reason of the execution of the work.

2.1.9 Charges shall not exceed the minimum Scale of Fees. (refer part 1.10)

2.2 ISSUING OF COMMISSIONS AND INSTRUCTION

In general, survey briefs will be issued by the Department under one of two categories:

2.2.1 Briefs

2.2.2 Minor Instructions

The Brief proposal will be submitted to the Design Priorities Committee of the Department by the Principal Surveyor for approval before issuing

a letter of commission.

An anticipated expenditure is included for funding purposes and the Brief does not become binding until a written letter of commission is issued to the Consultant. The reference project number will be included therein and all claims must contain reference thereto. (See part 2.3).

A Minor Instruction to a limited amount may be issued by the Principal Surveyor, and serves in effect as letter of commission.

The amounts referred to above are the amounts funded for the project, based on an estimate of the likely expenditure at the time of issuing of the Brief or Instruction.

If it appears likely during the course of the work, that this amount will be exceeded, the Consultant must inform the Principal Surveyor in writing, detailing reasons for likely over-expenditure and an estimate of the amount required to complete the Brief. No work whatsoever exceeding the amount of the Brief or Instruction may be performed without prior written permission from the Principal Surveyor.

2.3 ACCOUNTS

All claims for surveys shall be submitted in triplicate on the Department's standard claim form (See Appendix B) with relevant details entered, TOGETHER WITH a contingency form in triplicate attached. Time sheets etc shall be attached where claims are made on time basis charges in accordance with the Scale of Fees.

SECTION 3

FIELD NOTES

3.1 FIELD SHEETS

Field notes shall be recorded on standard Departmental loose field sheets. They shall be original, clear, concise, legible and presented in such manner that no ambiguity in the information is presented.

3.2 HORIZONTAL DETAILS

All angles and distances measured in the field should be shown, together with bearings, reduced chainages and connnections. In all cases the diagrammatic method shall be used with clear reference to Allotment and Portion numbers, natural features, permanent improvements, place names and relevant connections to boundary marks.

3.3 VERTICAL DETAILS

3.3.1 Levels for centreline surveys of urban roads, aerodromes, pipelines etc, shall be booked by the standard procedure using rise and fall method of reduction.

3.3.2 Bench Marks, Permanent Survey Marks and Permanent Recovery Marks shall be levelled during the forward run and checked on the return run, a change being made at all such marks on both runs.

3.3.3 Where EDM traversing is undertaken standard field traverse sheets shall be utilized. All vertical heighting shall be reciprocal, reduced separately and checked.

3.4 CROSS SECTIONS

For all rural roadworks, the standard method of cross sectioning as shown in Appendix C shall be used.

In all other cases, cross sections shall be recorded in the forward run of levels, using the rise and fall method with offset distances shown in cross section column.

3.5 PROJECT FIELD BOOKS

3.5.1 Field sheets of each survey project shall be combined to form a Project Field Book of not more than 100 pages.

Standard covers are to be used with "information required" to be completed.

Each field book shall have a preface, which will contain the following:

3.5.2 Index

3.5.3 Name of Persons carrying out survey

3.5.4 Equipment and Technique used

3.5.5 Closures

3.5.6 any other relevant information.

3.6 SIGNING

3.6.1 Each field sheet shall be initialled and dated by the person carrying out the survey.

3.6.2 Where the surveys are not carried out by a Surveyor, a Principal of the firm employing such officer shall countersign the project field books.

3.7 STANDARD ABBREVIATIONS

3.7.1 In order to unify field book notation, standard abbreviations will be used as shown below. Symbols used in field books will be as illustrated in Appendix A.

BM	Bench Mark	ITD	Invert Table Drain
BOB	Bottom Bank/Batter	K & G	Kerb & Gutter
CL	Centreline	LD	Local Depression
COG	Change of Grade	LR	Local Rise
CP	Change Point	MH	Manhole
DHW	Drill Hole & Wing	NS	Natural Surface
EB	Edge of Bitumen	OBV	Obvert
EC	Edge of Cliff	OCP	Original Concrete Peg
ELP	Electric Light Pole	PCP	Photo Control Point
ER	Edge of Road	PP	Power Pole
ES	Edge of Swamp	PSM	Permanent Survey Mark
EW	Edge of Water	RM	Recovery Mark
FH	Fire Hydrant	SD	Slop Distance
GIN	G.I. Nail	SL	Spot Level
HD	Horizontal Distance	SPK	Spike
HE	Height of EDM	TBM	Temporary Bench Mark
HR	Height of Reflector	TOB	Top of Bank/Barret
HI	Height of Instrument	TP	Tangent Point
HT	Height of Target	OLD	Open Lined Drain
HWM	High Water Mark	OUD	Open Unlined Drain
MHWM	Mean High Water Mark	PRM	Permanent Recovery Mark
IP	Intersection Point	PSM	Permanent Survey Mark
INV	Invert	WC	Water Course

SECTION 4

STANDARDS OF ACCURACY

4.1 MINIMUM STANDARDS

Minimum standards of accuracy shall be considered to be:

CATEGORY (units)	1	2	3	4	5 (EDM traverse with trig heighting)
General Linear Accuracy	1:10,000	1:5,000	1:2,500	1:500	1:20,000
Distance between 2 adjacent marks shall be within: (mm)	10	10	100	500	10
Unmarked points shall be measured to within: (mm)	100	500	500	500	100
Level Accuracy of adjacent marks to be within: (mm)	10	10	50	100	10
Level Accuracy unmarked points to be within: (mm)	100	100	200	500	100
Difference in forward/reverse runs between BMs: (mm)	$20\sqrt{K}$	$50\sqrt{K}$	$100\sqrt{K}$	N/A	$45\sqrt{K}$
Angular Closures	$10''\sqrt{N}$	$20''\sqrt{N}$	$50''\sqrt{N}$	N/A	$5''\sqrt{N}$
Angles to be true to within:	20"	30"	40"	N/A	10"

N = No. of set-ups
K = Kilometres

Reduced standards of accuracy may be approved by the Principal Surveyor only in exceptional circumstances.

* These tolerances are allowable only where distances involved make it impractical to attain the accuracies outlined for "General Linear Accuracy".

4.2 AZIMUTH DATUM

Azimuth Datum shall be taken from suitable cadastral, geodetic or engineering surveys or determined by a combined east and west solar observation or other acceptable methods to obtain a true value of AMG grid north to within 20 seconds.

4.3 MAGNETIC BEARING

Magnetic Bearing shall be determined within 1 degree magnetic.

SECTION 5

SURVEYS FOR ROADWORKS IN RURAL AREAS

5.1 LAND INFORMATION

If the road to be surveyed is located within customary land, the surveyor shall contact the Lands Officer prior to commencing the survey to discuss the job, allowing the Lands Officer to start proceedings. The proposed route shall be indicated to the Lands Officer, on the ground. Close liaison with the officers of the Provincial Government shall be kept.

For land dealings the following detail is required:

5.1.1 Sufficient connections to cadastral survey marks are required to enable accurate plotting of the road in relation to the cadastral boundaries.

5.1.2 Approximate location and notation of clan boundaries if possible.

5.1.3 Changes in land use and description of terrain.

5.1.4 Portion numbers. NLD's, UAL's or other references to purchase documents.

5.2 CENTRELINE

Except where impractical due to nature of terrain, centrelines are to be marked as a series of straights and circular curves with centreline marks placed as follows:

5.2.1 Straights are to be marked at 50m intervals on an even 50m of chainage.

5.2.2 Curves of radii 250m and greater are to be marked at 25m intervals on an even 25m of chainage.

5.2.3 Curves of radii from 50m to 250m are to be marked at 15m intervals on an even 15m of chainage.

5.2.4 Curves of radii less than 50m are to be marked at 10m intervals on an even of 10m of chainage.

5.2.5 Tangent points on all curves are to be marked. Curves are not to be pegged where the deflection is less than 1^{o}.

5.2.6 Where there is an existing road, the centreline shall follow the centre of the formation over its entire length, with only minor deviations, or as directed otherwise in writing.

5.2.7 In areas where there is no existing road, finders will be placed every 50 m in addition to the dumpy pegs.

5.3 RECOVERY MARKS

A pair of Recovery Marks shall be placed at all Tangent Points. On straights exceeding 250m in length, one pair of Recovery Marks shall be placed where practicable, opposite an even 250m of chainage, provided that such chainages do not lie within 50m of a position where marks would ordinarily be placed under other conditions of this clause.

On curves of arc length less than 100m, the IP only is required to be marked at the crown point. On curves of arc length from 100m to 250m, the IP plus a second radial recovery will mark the crown point. On curves of arc length 250m and more, a set of Recovery Marks will be placed every 100m. Generally it is desired that recovery marks shall be evenly disposed along the length of the roadworks, whilst complying with the above conditions. The marks shall be placed clear of future likely earthworks.

A pair of Recovery Marks are to be placed on the half angle at deflection points where no curve is pegged.

5.4 PERMANENT RECOVERY MARKS

The remote Tangent Point of every third curve and/or every third set of marks placed on straights, shall be Permanent Recovery Marks.

5.5 ADJUSTMENT

The centreline traverse shall be adjusted horizontally and vertically to fit perfectly with any control marks in accordance with sound survey practice.

5.6 LEVELLING

Centreline levels shall be obtained by differential levelling in the form of a continuous forward run, levels being taken on all Centreline and Recovery Marks, Bench Marks, Investigation Traverse Marks adjacent to the new centreline, on all features and structures that will affect or be affected by the design of the new road, any established Permanent or temporary survey marks and at each change of grade in the longitudinal section of the road centreline. Where directed, sections of the centreline may be levelled using tacheometric methods, provided that an overall level control is maintained as specified in the Standards of Accuracy. Levels on all Permanent Survey or Recovery Marks shall be change points.

5.7 STANDARDS OF ACCURACY

The centreline and recovery marks shall be established to an accuracy as outlined in Category 3 Section 4.

5.8 CROSS SECTION

The Standard Cross Section method to be adopted for rural roadworks shall be as detailed in Appendix C, wherein samples of Cross Sections are indicated together with standard field sheets to be used. See also Section 3 (Field Notes).

Cross Sections are to be taken at each marked point (excepting that on curves of radius less than 50m, every second marked point shall be sufficient) and at any other points necessary to give a true interpretation of the natural surface.

Cross Sections are to be taken square to the road centreline and to extend a minimum of 25m either side of the centreline, or to a sufficient distance in excess of 25m, to embrace the whole of the likely earth works of the new road, including side drains.

Level, tacheometer, or clinometer may be used for cross-sectioning as directed. For booking details see Appendix C.

5.9 WATER COURSE INFORMATION

(Where no bridge site survey is required). Full watercourse information is to be obtained, to give the location, level, grade and shape of any stream contained within the strip 50m either side of the road centreline. A minimum of two typical stream cross sections both upstream and downstream, including one at the centreline, are required. Compass, tape, and clinometer may be used for stream bed traversing. Wherever possible, flood height details are to be obtained by observation and/or local knowledge. If survey of catchment area is required, this will be indicated in specific cases.

5.10 GENERAL

Additional information to be collected shall include all existing buildings, fencelines, culverts, power and telegraph poles with height of wires above the natural surface, and any other structures or relevant features which fall within the limits of the cross sections or which will affect or be affected by the construction of the new road. Compass bearings and distances, or offset distances from the pegged centreline may be used as ties for this work. Where side roads are encountered, centreline pegging, levelling and cross sectioning will extend 100m along the side road.

The additional detail outline in this section is also required along the pegged extent of the side roads.

Care should be taken to adequately define the general location of the project for the benefit of design and construction staff. This may be done by speedometer readings from a town, village, road junction, river, etc. to the start and end of the project and by determination of the local names of villages, plantations, roads, rivers, etc. along the route. All information relevant to this paragraph should be on the plan.

5.11 OVERALL CONTROL

Overall vertical and horizontal control shall be maintained by a control traverse run in close proximity to the road or by traversing between intersection points.

This traverse may consist of:

5.11.1 A chain traverse combined with two way differential levelling to a standard of accuracy as outlined in Category 1 Section 4.

5.11.2 An EDM traverse combined with reciprocal trig heighting and one way differential levelling, to a standard of accuracy as outlined in Category 5 Section 4.

5.12 DATUM

5.12.1 Azimuth datum to be in accordance with Part 4.2. Check azimuths shall be obtained at the end of the survey and at intervals of no more than five kilometres in rugged country, and ten kilometres in flat country.

In order to avoid carrying on any gross errors in bearings, frequent checks with compass observations are recommended.

5.12.2 Level datum shall be Mean Sea Level, unless otherwise directed. The origin of levels shall be a Bench mark or permanent Survey Mark having a known value on the adopted level datum. The mark adopted should be connected by differential levelling to an adjoining known mark and an agreement, within the required standard of accuracy attained, unless otherise directed.

5.13 CLOSURES

A Summary of principal vertical, horizontal and azimuth closures are to be shown at the front of the field book.

Any closures made to the geodetic network shall be calculated on the AMG.

5.14 CO-ORDINATES

Co-ordinates, if required, shall be plane rectangular Ground Co-ordinates, starting with an arbitrary value and using horizontal ground distances and AMG plane bearings. The Principal Surveyor may approve the use of a Datum Plane Co-ordinate System in some instances.

5.15 PERMANENT SURVEY MARKS

Pairs of intervisible Permanent Survey Marks shall be placed as part of the control traverse, approximately every 2 kilometres in accordance with parts 2.8 and 3.9 of the Survey Directions 1980. (Note that AMG co-ordinates are required on PSM sketches).

5.16 BENCH MARKS

Permanent Survey Marks and Permanent Recovery Marks shall be considered as Bench Marks and Temporary Bench Marks respectively.

5.17 PLANS

Survey plan requirement will be stated with each commission.

SECTION 5A

INVESTIGATION SURVEYS FOR ROADWORKS IN RURAL AREAS

5A.1 LAND INFORMATION

If the strip of interest to be surveyed is located within customary land, the surveyor shall contact the Lands Officer prior to commencing the survey to discuss the job, allowing the Lands Officer to start proceedings. The proposed route shall be indicated to the Lands Officer, on the ground. Close liaison with the officers of the Provincial Government shall be kept.

For land dealings the following detail is required:

5A.1.1 Sufficient connections to cadastral survey marks are required to enable accurate plotting of the strip in relation to the cadastral boundaries.

5A.1.2 Approximate location and notation of clan boundaries if possible.

5A.1.3 Changes in land use and description of terrain.

5A.1.4 Portion numbers. NLD's, UAL's or other reference to purchase documents.

5A.2 GENERAL

The aim of this method of survey is to obtain sufficient data over a strip of interest for preliminary design and to provide adequate control.

5A.3 INITIAL ROAD LOCATION

The general route location is to be selected on site by the Project Engineer, but this does not preclude the Surveyor from liaising with the Engineer on location problems or obtaining data which, in his opinion, would provide a more suitable alternative for the route.

The initial centreline gradient, in most cases, is to be proven by clinometer and a walking track cleared out. Trees along the route are to be blazed and referenced occasionally with aluminium tags or similar, for re-identification purposes.

Gradients, compass bearings, approximate distances, side slopes and any other relevant information such as slips, rock faces, soil types etc, are to be recorded on standard Departmental field sheets in diagrammatic form.

A horizontal and vertical plot of the survey may be required for study by the Project Engineer on site, who will decide if further survey is required and to what extent.

5A.4 INVESTIGATION TRAVERSE

Once the initial centreline has been accepted by the Project Engineer, a vertical and horizontal investigation traverse is to be executed following the proposed centreline as closely as possible. Where curves are encountered, approximately 50 metre chords shall form part of the traverse. The investigation traverse is to be profiled by obtaining levels at changes of grade only, or every 50 metres on long even grade lines.

This traverse is to be adjusted, in sections, to close perfectly with the control traverse, and where practicable, may form part of the control (refer part 5A.4).

The standard of accuracy shall be as specified in Category 4 Section 4.

5A.5 CONTROL TRAVERSE

An EDM control traverse is to be executed within the area encompassed by the road investigation. Control points are to be marked as Permanent Recovery Marks and should generally be placed about 500 - 750 metres apart where permanence is assured, or offset, if considered necessary.

Once the Investigation Traverse has been adjusted to the Control Traverse, the latter must not be changed or amended in any way. Any subsequent misclosures between the control and existing survey marks can be noted on the final survey control plan. (refer part 5A.8).

In instances where it is not possible to maintain reasonable length lines on the control traverse, it would be acceptable to control the investigation traverse by radiations from a trig station or major control point or, if praticable, the accuracy of the control traverse could be increased by tie lines.

Pairs of intervisible Permanent Survey Marks shall be placed as part of the control traverse approx every 2 kilometres in accordance with parts 2.8 and 3.9 of the Survey Directions 1980.

Where co-ordinates are required, part 5.14 of these Instructions will apply, except where the mark is a PSM. In this case the provisions of part 3.9 of the Survey directions 1980 will be complied with.

If any close salient feature overlooks a fair portion of the road, a control station should be placed and beaconed if considered advantageous for the construction setting out or for future engineering investigation of any nature.

The main purpose of the control traverse is:

5A.5.1 to close the investigation traverse for position and level;

5A.5.2 to set out construction from any point;

5A.5.3 to set out cadastral boundaries when necessary;

5A.5.4 to integrate the overall project.

The standard of accuracy shall be as specified in Category 5 Section 4.

Datum should be obtained from the trig network whenever possible. Azimuth in all cases shall be AMG plane bearing. Check azimuth shall be obtained in accordance with part 5.12.

5A.6 CROSS SECTIONS

Cross Sections are to be recorded on standard Departmental field sheets, using one of a combination of one of the methods, as set out in Appendix C.

It is the surveyor's responsibility to ensure that cross sections are taken at essential points such as tops of rises, beds of gullies, and changes in profile or crossfall and that full detail is obtained to give a true interpretation of the natural surface within the strip of interest.

Detail within this band that cannot be fully obtained by cross sectioning, such as with water courses, must be acquired and recorded separately.

5A.7 WATERCOUSE INFORMATION

In accordance with part 5.9.

5A.8 ADDITIONAL INFORMATION

In accordance with part 5.10.

5A.9 PLANS OF SURVEY

Generally a 1:2500 plot in ink is required of the adjusted investigation traverse, showing adjusted bearings and distances, co-ordinates, reduced levels plus control connections and subsequent closures. This plot is to be supplied in sections as the survey progresses and will generally be the basic plot to be utilized by the Designer.

A plan of the survey control is to be provided at the end of the project at a suitable scale showing control traverse details, bearing and distances, co-ordinates, reduced levels, datum, methods of survey, closes on trigs and all other relevant data required for survey co-ordination usage. Sketch detail of the topographical features plus the approximate position of the proposed road, is to be added. (Refer Appendix F for standard control survey plan).

SECTION 6

SURVEY FOR SUBDIVISIONAL ROADS WITHIN URBAN OR SUBURBAN LANDS

6.1 STANDARD OF ACCURACY

Standards of Accuracy shall be as in Category 2 Section 4. (Stadia shall be Category 4, Section 4.

6.2 CENTRELINE

Part 6.1 shall apply except:

6.2.1 On straights, centreline marks are to be located at intervals not exceeding 25m and where possible on even 25m chainage.

6.2.2 At deflection points on the centreline where the intersection angle is less than 5^0, no curve shall be pegged.

6.2.3 At deflection points on the centreline where the intersection angle is greater than 5^0, a curve is required to be pegged. Such curves shall give a minimum 8m clearance between the centreline and the boundary on 20m road reserves and a minimum 6m clearance on 15m road reserves.

6.2.4 Chainage 00 for each roadway to be located at the centreline intersection with the abutting roadway and, with the exception of cul-de-sacs, at the end of the roadway nearest to the town centre.

6.3 RECOVERY MARKS

The appropriate parts of part 5.3 will apply.

6.4 PERMANENT RECOVERY MARKS

PRMs shall be placed on the prolongation of the centreline of all roads, clear of future likely earthworks.

Where directed, and when road boundaries have not been previously marked, these marks shall form the basis of control for the cadastral survey in liaison with the Surveyor General.

In the above case, such additional PRMs as deemed necessary for the full control of both the engineering and cadastral surveys and the setting out of services shall be placed. In addition their relationship with the external boundaries of the subdivision shall be obtained in order that pre-calculation of internal lot boundaries can be made.

6.5 PERMANENT SURVEY MARKS

In urban areas these shall be placed at the direction of the Surveyor General.

6.6 LEVELLING

All levelling shall be carried out by differential levelling. The marked centreline of each roadway to be levelled, levels being taken on each mark and at each change in grade in the longitudinal section of the roadway.

Centreline levels and cross sections shall extend for at least 100m along existing road formations where such formations form a junction with or extension of the new roads.

6.7 CROSS SECTIONS

The relevant parts of Section 5 will apply.

6.8 DATUM

6.8.1 Azimuth Datum shall be taken from existing cadastral surveys where possible, otherwise determination shall be in accordance with part 4.2.

6.8.2 Level datum is to be established from a known Bench Mark or PSM unless otherwise directed.

6.9 DRAINAGE

Watercourses shall be surveyed so as to give the location, level, grade and shape of the stream over a distance of 100m upstream and downstream of the road centreline.

Sufficient additional information is to be obtained, to locate the entire waterway system affecting the drainage of the roads concerned. Where this appears to be extensive, discussions with the Principal Surveyor should be held before commencing work.

6.10 GENERAL

Additional information as set out in part 5.9 is required to be established to an accuracy in accordance with Category 3 Section 4.

Plan requirements and general arrangement of survey marks are shown in Appendix E. The Principal Surveyor may require that the provisions of Appendix M are complied with.

SECTION 7

BRIDGE SITE SURVEYS

7.1 LAND INFORMATION

If the bridge site to be surveyed is located within customary land, the surveyor shall contact the Lands Officer prior to commencing the survey to discuss the job, allowing the Lands Officer to start proceedings. The proposed route shall be indicated to the Lands Officer, on the ground.

Close liaison with the officers of the Provincial Government shall be kept.

For land dealings the following detail is required:

7.1.1 Sufficient connections to cadastral survey marks are required to enable accurate plotting of the bridge site in relation to the cadastral boundaries.

7.1.2 Approximate location and notation of clan boundaries if possible.

7.1.3 Changes in land used and description of terrain.

7.1.4 Portion numbers. NLD's, UAL's or other reference to purchase documents.

7.2 STANDARD OF ACCURACY

Standard of Accuracy will be Category 1 Section 4 except for topographic detail only which will be Category 4 Section 4.

7.3 CENTRELINE

The Centreline of the proposed structure shall be marked and levelled to enable a longitudinal section to be plotted. This section shall extend far enough to enable the design of such approaches, as will necessarily be constructed in connection with the bridge. Where the approaches to the bridge are on a curve, the straight profile shall be extended to the limits of the flood plain, in addition to the profile along the true approach centreline.

7.3.1 Additional stream profiles are required, at a distance of 10 m and 20 m on either side of the centreline.

7.4 PERMANENT RECOVERY MARKS

Permanent Recovery Marks shall be placed on either side of the marked centreline at marked chainage points both sides of the stream, such, that the bridge centreline can be readily and accurately reinstated.

Generally, the Permanent Recovery Marks shall be at right angles to the centreline and 20m or more distant from where disturbance by construction or maintenance work is likely to occur.

7.5 BENCH MARK

A Bench Mark shall be establshed. Where the stream is more than 100m wide, a Bench Mark shall be established on both sides.

The Bench Mark shall be placed where it will not be disturbed by construction of the bridge or approaches. Where possible, the Bench Mark shall be located so, that levels on the new structure may be transferred with only one setting up of the instrument.

7.6 LEVELLING

Centreline marks, Permanent Recovery Marks, existing structures and BMs shall be levelled with automatic or spirit levels. Stadia may be used for all other information.

7.7 STREAM INFORMATION

7.7.1 For stream width up to 30 metres, sufficient information shall be obtained to enable the location, cross sectional shape and grade of the stream to be determined for a distance of 75m upstream and downstream of the centreline. The investigation shall extend beyond the high banks to include all relevant detail to the bridge design.

7.7.2 For stream width over 30 metres, the length of stream to be surveyed as outlined in part 7.7.1. shall be increased to be approximately 2.5 times the bank to bank width, upstream and downstream of the centre-line.

7.7.3 The hydraulic gradient is to be obtained using the water level for a distance of 200m up and downstream, levels being taken on each bank, every 75m.

7.7.4 Particular attention shall be paid to the location of scours, rock outcrops, shoals, creek juctions and any other natural or artificial features, which may affect the design of the bridge or approaches.

7.7.5 Where a bridge site is located close to the mouth of the river, ie. Tidal river, water levels will be obtained at the centreline and at sea level at regular interval over a 24 hour period.

The location of any obstructions e.g. sandbanks etc, in the immediate vicinity of the river mouth, will be noted.

7.7.6 Sufficient information is to be obtained in order that 0.5m contours may be plotted within 10m of the proposed centreline, and 1m contours in other areas.

7.8 AZIMUTH

As for Section 4.2.

7.8.1 MAGNETIC BEARING

Magnetic Bearings may only be used if directed by the Project Surveyor.

7.9 PHOTOGRAPHS

Photographs are to be taken of the site from upstream and downstream, looking across the proposed centreline.

Information regarding the location from which the photographs are taken and the direction of such are to be noted on the photographs and on the survey plans.

7.10 GENERAL

7.10.1 Observed high flood levels should be obtained upstream and downstream and at the bridge site and where possible, a cross section of the stream bed at such points, is to be obtained.

7.10.2 All existing road approaches shall be located, sufficiently beyond the flood plain, or for 200 m, whichever is the longest, to facilitate design of the new approaches. However, where the site is on an existing road survey, this detail may be omitted where directed, but the chainage along the bridge centreline is to be connected to the road survey chainage.

7.10.3 A dimensioned sketch, with deck level, of any existing structure is to be shown.

7.10.4 The Site Information Form (see Appendix G) must be completed and returned with the field books.

7.11 WHERE THE CENTRELINE HAS NOT BEEN FIXED

Where the centreline of the proposed structure has not been fixed, it may be necessary to investigate one or more sites in order to make a final decision on the centreline.

In this case, investigation surveys where requested, shall include all the requirements of Bridge Site Surveys.

The work shall take the form of a stadia investigation, locating all detail as described.

A Bench Mark need not be established but at least two traverse stations adjacent to the crossing site shall be Permanent Recovery Marks, preferably one on each side of the stream, and remote from the flood plain. The standard Bridge Site Survey form (see Appendix G) must be completed and returned with the field books.

7.12 PLANS

A plan on a standard Departmental plan A1 Sheet is required at a scale of 1:500 unless otherwise directed. The plan shall include centreline and traverse information, reduced levels, contours and all other relevant survey data, and local name of stream, if any.

The longitudinal section (7.3) is to be plotted on the same sheet at a scale of 500 horizontal, 1:50 vertical.

A locality sketch, showing the location of the bridge site with a distance (speedo readings will suffice) to the nearest town or village, at a scale of 1:100000 shall be shown on the bridge site plan.

SECTION 8

AERODROME SURVEYS

8.1 LAND INFORMATION

If the aerodrome to be surveyed is located within customary land, the surveyor shall contact the Lands Officer prior to commencing the survey to discuss the job, allowing the Lands Officer to start proceedings. The proposed site shall be indicated to the Lands Officer, on the ground.

Close liaison with the officers of the Provincial Government shall be kept.

For land dealings the following detail is required:

8.1.1 Sufficient connections to cadastral survey marks are required to enable accurate plotting of the aerodrome in relation to the cadastral boundaries.

8.1.2 Approximate location and notation of clan boundaries if possible.

8.1.3 Changes in land use and description of terrain.

8.1.4 Portion numbers. NLD's, UAL's or other references to purchase documents.

8.2 STANDARDS OF ACCURACY

The Standard of Accuracy shall be as in Section 4, Category 2.

8.3 CENTRELINE

Centreline marks shall be placed every 25m with a running chainage. On existing aerodromes, the marked line shall be offset from true flightstrip centreline as specified in the Brief. On new sites, the centreline shall be marked.

8.4 PERMANENT MARKS

8.4.1 A pair of Permanent Recovery Marks shall be placed opposite each 250m of running chainage, distant 50m right and left, where practicable, from the true centreline.

8.4.2 A Permanent Survey Mark shall be placed at each end of the aerodrome on the prolongation of the true centreline, clear if practicable, at least 30m from the flightstrip cone markers and the chainage therefore shall be connected to the Survey.

8.5 BENCH MARK

The Permanent Survey Mark on the true centreline prolongation closest to the apron area shall become the Aerodrome Bench Mark.

8.6 DATUM

8.6.1 Level datum shall be taken from a known Bench Mark or existing P.S.M. Where there are no known Bench Marks or PSM's, datum shall be determined by barometric methods.

8.6.2 Azimuth shall be grid north for the A.M.G. and may be obtained from cadastral surveys. Otherwise, the azimuth shall be established by compass and is to be shown as G.N.M.D (Grid North Magnetic Determination).

8.7 CHAINAGE

8.7.1 Unless otherwise specified in the Brief, chainage 00 shall be the PSM located at the lower end on the aerodrome. On the existing aerodromes, the end of the runway formation, if easily defined, shall be shown in the running chainage together with the end of flightstrip cone markers.

8.7.2 If the runway is sealed, chainage markings are to be painted on the bitumen in accordance with D.W.S. plan A.S. 03.

8.8 LEVELLING

8.8.1 Levels shall be taken at every marked point along the centreline. Intermediate levels shall also be taken at changes of grade and wherever necessary to enable a true section along the centreline to be drawn.

8.8.2 Cross-sections shall be taken square to the centreline on the 25m chainage marks and whenever necessary to enable accurate earthwork quantities to be calculated. The cross-sections shall extend left and right to the extent specified in the Brief.

8.8.3 On new sites, levels shall be taken left and right every 15m across the section and at changes of grade.

8.8.4 On existing aerodromes, levels shall be taken left and right every 15m across the section, as well as on the true centreline, edge of any runway formation, line of conemarkers and at changes of grade.

8.8.5 The cross-sections shall be extended and the interval between them halved, to provide a 12.5m x 12.5m grid over any apron areas. Any additional levels necessary to give a true ground configuration shall also be provided.

8.8.6 Details of any taxiway levelling requirements will be included in the Brief.

8.9 PREVAILING WINDS

In the case of a new aerodrome, the prevailing wind should be ascertained and shown in the field book as a bearing.

8.10 APPROACH AND TAKE-OFF SURFACES

Details of any approach/take-off surface survey requirements will be included in the Brief.

8.11 FIELD NOTES

Physical features and details shall be shown in relationship to the centreline. These shall include any fences, buildings (together with floor level and occupancy), roads, towers, powerlines, drains, water courses, hills, beaches, limits and type of vegetation, soil types, rock out-crops, cadastral boundaries, etc.

8.12 PLANS

8.12.1 A stable base plot showing cadastral boundaries, fences, buildings, formations, location of runway, taxiway and apron formations, location of conemarkers and any other details picked-up in the survey, including all chainages and levels, shall be prepared at a scale of 1:1000.

8.12.2 A similar plan of the apron area and environs shall be prepared at a scale of 1:500.

8.13 SAFETY

8.13.1 It is the Surveyor's responsibility to ensure that the Director of Civil Aviation, in the Department of Transport and Civil Aviation, and the Aerodrome Branch, Department of Works and Supply, are notified at least one week prior to commencement of any survey work.

8.13.2 All survey marks placed within the area of flightstrip cone-markers are to be flush with the ground and no indicators or other markers are to be placed.

8.13.3 Whilst aircraft are taxiing, taking-off or landing, all vehicles, instruments, tapes, personnel, etc are to remain outside the line of flightstrip conemarkers, clear of all aerodrome clearance surfaces.

SECTION 9

ARCHITECTURAL SITE SURVEYS

9.1 LAND INFORMATION

If the Architectural site to be surveyed is located within customary land, the surveyor shall contact the Lands Officer prior to commencing the survey to discuss the job, allowing the Lands Officer to start proceedings. The proposed site shall be indicated to the Lands Officer, on the ground.

Close liaison with the officers of the Provincial Government shall be kept.

For land dealings the following detail is required:

9.1.1 Sufficient connections to cadastral survey marks are required to enable accurate plotting of the architectural site in relation to the cadastral boundaries.

9.1.2 Approximate location and notation of clan boundaries if possible.

9.1.3 Changes in land use and description of terrain.

9.1.4 Portion numbers. NLD's, UAL's or other reference to purchase documents.

9.2 The Standards of Accuracy shall be as in Section 4 Category 4, with the following exceptions:

9.2.1 The distance between marked points or permanent structures will be accurate to 0.10 (Section 4 Category 3) and

9.2.2 The pair of Permanent Recovery Marks shall be placed to an accuracy as in Section 4 Category 1.

9.3 DETAIL REQUIREMENTS

The purpose of these surveys is to gather sufficient information to enable an accurate detail and contour plan to be drawn, as a result of which proposed structures and extensions can be located. Sufficient information shall be provided to enable 0.5m contours to be plotted, unless otherwise directed, and shall extend at least 20m into adjoining properties. Generally, at the discretion of the Surveyor, the work shall be done by stadia. In some instances, a regular grid of levels will be required.

Detail information required when carrying out surveys of Architectural sites includes:

9.3.1 Buildings of permanent or temporary materials and floor levels;

9.3.2 Levels on edge and centreline of existing internal and adjoining sealed and unsealed roads;

9.3.3 Kerb and guttering if existing;

9.3.4 Footpaths and tracks;

9.3.5 Transmission lines, power and telephone poles and related services. (height of wires to be noted);

9.3.6 Natural or artificial drainage systems;

9.3.7 Manholes, septic tanks, sewerage lines etc.;

9.3.8 Water supply lines, hydrants, stop valves etc.;

9.3.9 Well established trees or trees of possible ornamental value, with indication of height, spread and type if possible;

9.3.10 Any other relevant features such as large rocks, old building foundations, concrete slabs etc, which could affect construction;

9.3.11 Soil description.

9.3.12 It is essential that subject or adjacent boundary marks are accurately located and sufficient connections obtained in order that the boundaries may be plotted.

9.4 DATUM

9.4.1 Azimuth datum shall be taken from existing cadastral surveys wherever practical, otherwise determination shall be in accordance with Part 4.2.

9.4.2 Level datum shall be taken from an existing Bench Mark or Permanent Survey Mark if available, otherwise an assumed datum can be adopted from a newly established PSM or TBM.

9.4.3 At least one Temporary Bench Mark shall be provided on a permanent improvement such as a concrete step, floor, path etc where possible.

9.5 PERMANENT RECOVERY MARKS

A pair of Permanent Recovery Marks will be established clear of any likely disturbance and their levels and interrelationship recorded for any future setting out of design.

9.6 PLAN REQUIREMENTS

A plan shall be drawn at a suitable scale, generally 1:100, 1:200, 1:250 or 1:500, depending on the area and detail concerned, showing all relevant information including spot heights and contours.

SECTION 10

CONTROL SURVEYS

10.1 There are basically two kinds of control survey:

10.1.1 Project Control, which usually consists of an EDM traverse, the main purpose being,

10.1.1.1 to provide a framework for lower order engineering surveys.

10.1.1.2 to provide adequate permanent marking for reinstatement at a later date.

10.1.1.3 to provide a basis for land acquisition purposes as defined in Appendix M.

10.1.1.4 to set out for construction.

10.1.2 Photogrammetric Control, the purpose being to provide sufficient horizontal and vertical control for project mapping.

10.2 STANDARDS OF ACCURACY

The Standards of Accuracy will be as for Section 4 Category 5.

10.3 METHOD OF MARKING

10.3.1 All traverse stations will be Permanent Recovey Marks with a 50 mm x 20 mm x 750 mm hardwood marker painted white.

10.3.2 Sufficient measured ties from the PRM to permanent features are to be obtained, to assist in the relocation of the mark.

10.3.3 At intervals of 2km, or thereabouts, a pair of Permanent Survey Marks (with the necessary reference marks) will be used as traverse marks.

10.4 METHOD OF OBSERVATION

Consistent with the Standards of Accuracy in Section 4 Category 5 the following will apply:

10.4.1 Horizontal angles are to be the mean of 2 arcs (an arc consisting of 2 face left and 2 face right observations in each direction) with a single second theodolite in good adjustment. If the two arcs differ from each other by more than 10", additional arcs are required.

10.4.2 Distances are to be measured with a properly calibrated EDM and are to be corrected for atmospheric conditions.

10.4.3 Vertical angles are required for trig heighting as well as slope reduction. They shall consist of the mean of 2 face left and 2 face right readings from each end of a line, and although simultaneous observations are not essential, as little time as possible should elapse between measurements.

10.4.4 Heights of Instruments, targets and reflectors are to be carefully measured and recorded.

10.4.5 Differential levelling, where required shall be carried out with a properly adjusted automatic instrument in accordance with the Standards outlined in Section 4 category 1, unless otherwise directed.

10.5 DATUM

Azimuth datum is to be in accordance with part 4.2.

Level datum is to be obtained from the existing trig network, or an established Bench Mark or Permanent Survey Mark.

10.6 METHOD OF COMPUTATION

Unless otherwise directed, the provisions of parts 5.13, 5.14, and 5.15 will apply.

10.7 ADDITIONAL REQUIREMENTS FOR PHOTOGRAMMETIC CONTROL

10.7.1 Photo Control Points - Existing Photography

10.7.1.1 Photo Control Points are to be located to appear in at least one overlap and preferably two, and shall be checked in the field by stereoscopic vision.

10.7.1.2 Points chosen are to be clear of shadow and obstruction on the photograph, and should be no closer than 10mm from the edge.

10.7.1.3 Horizontal points must have a sharp image and be of clear contrast with the background. Intersection of fences, corners of eaves or walls are recommended.

10.7.1.4 Vertical points should be level ground near clearly identifiable detail.

10.7.1.5 Selected points are to be carefully pricked through the photograph and circled, numbered and described on the reverse side.

10.7.1.6 At each photopoint station, a minimum of two points should be measured where possible.

10.7.2 Photo Control Points - Pre Marking

10.7.2.1 The type of mark, size and general location will be specified in the Brief. Recommended material for targets is lap lap, yellow plastic or similar substance of suitable durability and contrast.

10.7.2.2 To check that the target area is clear of any overhead obstruction, the surveyor must insure that no obstruction appears above a line measured at 50^0 from the vertical.

10.7.2.3 The Photo Control Point Sketch must be prepared accurately, showing the shape, size and orientation of the target together with any additional detail, to ensure that a positive identification can be made by the photogrammetrist.

10.7.3 Photo Control Point - Sketches

Photo Control Point Sketches are required as detailed in Appendix H.

10.7.4 Photo Control Point Accuracy

The accuracy requirements will be specified in the Commission of Survey, but in general the requirement is approximately 0.20 metres in position both horizontally and vertically for large scale engineering mapping.

10.8 CADASTRAL BOUNDARIES

Sufficient connections to cadastral marks are required to enable any relevant cadastral boundaries to be accurately plotted.

10.9 TOPOGRAPHIC DETAIL AND NOMENCLATURE

The names and locations of villages and settlements, rivers, creeks, road junctions etc that are in close vicinity, are to be obtained. A note is to be taken of the type of country through which the survey traverses and clan boundaries, and names if possible.

10.10 PLAN OF SURVEY

Plan requirements will be generally as set out in Part 5A.9, except for Photo Control, a smaller scale, sufficient to show relevant survey data, would be acceptable.

SECTION 11

WATER SUPPLY AND SEWERAGE PIPELINE SURVEYS

11.1 LAND INFORMATION

If the water or sewerage pipe line to be surveyed is located within customary land, the surveyor shall contact the Lands Officer prior to commencing the survey to discuss the job, allowing the Lands Officer to start proceedings. The proposed route shall be indicated to the Lands Officer, on the ground.

Close liaison with the officers of the Provincial Government shall be kept.

For land dealings the following detail is required:

11.1.1 Sufficient connections to cadastral survey marks are required to enable accurate plotting of the pipe line in relation to the cadastral boundaries.

11.1.2 Approximate location and notation of clan boundaries if possible.

11.1.3 Changes in land use and description of terrain.

11.1.4 Portion numbers. NLD's, UAL's or other references to purchase documents.

11.2 CENTRELINE

The centreline of a proposed water or sewer line is to be traversed as a series of straight lines and pegged every 30m and at proposed manholes or bends in water mains.

In urban areas, the pipeline will generally be on an offset of 1.52m for sewers or 3.13m for water mains inside and parallel to the road reserve boundary, except where ground features prevent it or unless otherwise directed.

11.3 RECOVERY MARKS

A pair of Recovery Marks shall be placed at all bends and junctions or every 300 metres apart, whichever is the lesser.

Wherever possible, permanent improvements, eg. power poles, fence posts, corner of buildings, drill holes in kerbs, culverts, pathways, etc and cadastral marks shall be used as Recovery marks.

11.4 PERMANENT RECOVERY MARKS

Every third set of recovery marks shall be Permanent Recovery Marks with the proviso, that connections (and levels) to cadastral boundaries or adjacent permanent features are acceptable in lieu of Permanent Survey Marks.

11.5 BENCH MARKS

A Bench mark in the form of a Permanent Survey Mark shall be established at intervals of about one kilometre clear of any likely disturbance. Existing PSMs may be used for this purpose.

11.6 STANDARD OF ACCURACY

Standards of Accuracy shall be as outlined in Category 2 Section 4.

11.7 ADJUSTMENT

The centreline traverse shall be adjusted horizontally and vertically to fit perfectly with any control marks in accordance with sound survey practice.

11.8 LEVELLING

Levels shall be obtained by differential levelling in the form of a continuous forward run, levels being taken on all centreline and recovery marks, on all features and structures that will affect or be affected by the design, any established Permanent or Temporary Survey Marks and at each change of grade in the longitudinal section. Where directed, sections of the centreline may be levelled using tacheometric methods, provided that an overall level control is maintained as specified in the Standards of Accuracy. Levels on all Permanent Survey and Recovery Marks shall be change points.

11.9 CROSS SECTIONS

Generally cross sections will not be required. However, any relevant feature or structure that falls within the proposed easement area or that may affect design, shall be connected to and levelled.

11.10 ADDITIONAL DETAIL

11.10.1 Additional topographic detail in the form of a strip of interest may be required where final location of sewer can not be clearly defined and this will be directed on the ground by the Project Engineer. Additional details at creek crossings will always be required.

11.10.2 Details of services and structures located within this strip of interest are required. Also refer part 11.12.

11.11 SURVEY DATUMS

11.11.1 Level datum shall be obtained from the Local Town Datum.

11.11.2 Azimuth datum shall be taken from existing cadastral surveys where possible, otherwise determination shall be in accordance with part 4.2.

11.12 CONNECTIONS TO EXISTING SERVICES

Where the proposed pipeline is to connect to existing pipelines or services or the construction may interfere with existing services or structures, which cross the route, their location shall be established both horizontally and vertically.

Particular attention shall be paid to the location of underground services and invert levels, pipe diameter and type and point of crossing with proposed pipeline, must be obtained.

11.13 PLANS

The Project Surveyor will indicate Engineering Survey Plan requirements. (Usually at scale 1:500).

APPENDICES

DEPARTMENT OF LANDS SURVEYS AND ENVIRONMENT APPENDIX M

SURVEY DIVISION

19-7-2

Circular: SAC 20 29-7-15

19-7-8

TO Regional Surveyors

Chief Draftsman 1 October 1981

Senior Project Officer

Principal Surveyor DWS

Principal Surveyor Elcom

ACQUISITION SURVEYS - RESERVES FOR PUBLIC PURPOSES

In this Circular:

Reserves include land required for roads, water, sewerage, power, drainage, etc from land held under any tenure.

Authority includes any Government agency requesting acquisition.

1. The prime requirement in any acquisition is that the reserve boundaries are clearly and unambiguously defined either;

(a) by marks on the ground, by normal survey.

or

(b) by reference to a pegged centreline

or

(c) by reference to an accurate traverse

2. It should be noted that, if this Department has to resort to compulsory acquisition procedures to obtain the land required, a written description has to be made up, and although this is qualified by "be it a little more or less" the declared bearings and distances fairly definitely define the acquisition. If the description is based on survey other than one carried out under the normal provisions of the Survey Directions, we could be required in the future to locate the description, or parts of it, on the ground. Unless we have reasonably accurate base survey information, this location would be impossible.

3. Acquisition, compulsory or otherwise, will not be initiated over land the boundaries of which are not pegged unless and until the Surveyor General certifies that the plan is of sufficient accuracy to enable future definition of the declared boundary. This would normally require reference to a traverse of at least the accuracy required by Parts 4 or 6 of the Directions as appropriate, and certified by a Registered Surveyor. Where a Registered Surveyor is not available, the Surveyor General may accept certification from the Chief Surveyor of the Authority.

4. Where reserves are not surveyed as directed in part 5 of the Directions, the following shall be adopted.

(a) A control traverse at least third order accuracy shall be made following the approximate route, with each traverse point permanently marked and with a pair of Permanent Survey Marks placed every two kilometres.

As is normal practice, full details of the traverse and marking shall be lodged with the National Mapping Bureau.

(b) The centreline shall be determined in relation to the traverse, and this shall generally be no further from the traverse than 100 metres. A distance of more than 100 metres would be acceptable, provided that the length over which it was more than 100 metres did not exceed one kilometre.

Purchasing officers will eventually use the pegged centreline to define the purchase boundaries by measuring off on each side.

(c) On receipt of centreline information, the bearings and distances of the reserve boundaries shall be determined, making allowance for any width variations for large side cuts, fills, etc.

Bearings and distances shall be rounded off as directed in Parts 4 and 6 of the Directions, as appropriate.

(d) A plan shall be prepared on a standard cadastral plan form showing:

(i) The control traverse, giving bearings and distances (tabulated if necessary), together with the height and scale factors for each Permanent Survey Mark.

(ii) The reserve boundaries, together with connections to the control traverse at intervals of no more than one kilometre and at every Permanent Survey Mark.

(iii) All existing cadastral surveys, sufficiently connected so that they may be plotted accurately in relation to the control traverse and the reserve boundaries.

(e) The plans shall be lodged with the Regional Surveyor in whose Region the survey is located, and be subject to normal procedures.

At the option of the Authority, un-numbered copies of the plan, bearing the notation "FOR INVESTIGATION PURPOSES ONLY" may be sent to officers responsible for arranging acquisition investigations.

(f) On receipt of Registered plans at HQ, arrangements will be made:

(i) For transfer of clan boundaries to a sepia of the plan, and calculation of areas of land to be acquired from each plan.

(ii) Issue survey instructions to survey any reserved areas to be acquired from existing portions: (see paragraph 7 below).

At the discretion of the Survey General, the procedures in this sub-paragraph may be carried out on receipt of the un-examined plan.

(g) Field notes shall not be required, however a statement shall be prepared on a separate sheet of paper, making the declarations as required by the Directions, but changing "Field notes herein contained," to "information from which the plan is compiled".

(h) It is not necessary to peg reserve boundary corners, unless required for a particular purpose. The corner shall be marked on the plan with a solid filled in circle. If marked, a normal open circle would be used.

(i) Apart from the exceptions noted above, provisions of the Survey Directions shall apply.

5. The Surveyor General may, at his discretion, permit a relaxed standard of survey and presentation.

(a) For reserves in rural areas, of no greater length than one kilometre:

(i) A marked survey carried out to Rural Class 3 standards but presented on an Acquisition or Miscellaneous plan form.

(ii) A pegged centreline, of accuracy of at least 1 to 250, with permanent reference marks at least every 250 metres drawn on an Acquisition or Miscellaneous plan form showing:

Centreline traverse details, method, marking, standard of accuracy etc.

Sufficient cadastral pick up to allow accurate plotting of existing cadastral information.

Bearings and distances of land required, rounded off to accord with the accuracy of the centreline traverse.

(b) For reserves in rural areas, longer than one kilometre:

(i) as in (a) above

or

(ii) as in (a) (ii) above, except that the centreline traverse shall be to an accuracy of 1 to 2500, referenced to two Permanent Survey Marks at least every two kilometres, and with additional permanent reference marks every kilometre.

(iii) Should the State Solicitor agree to a schedule for a compulsory acquisition referring only to a plan reference number and not to a metes and bounds description, as in (a) (ii) above, where the land is in an undeveloped state.

(c) For reserves in Urban areas of any length, as in (a) (ii) above, except that the centreline traverse shall be to an accuracy of 1 to 5000 and referenced to two Permanent Survey Marks every kilometre.

It may be anticipated that the Surveyor General's discretion will be automatically applied in undeveloped rural areas.

Under no circumstances may standard survey marks (except Permanent Survey Marks) be used on surveys carried out under this paragraph. Marks used must be durable in nature and steel fence posts, 750 mm long are recommended. Type of mark used, shall be shown on the face of the plan.

Normal requirements of the Directions regarding Permanent Survey Marks shall apply.

6. Sufficient information shall accompany any plans submitted, to enable easy plotting of clan boundaries which almost certainly will have been located with reference to centreline chainages.

7. When plans are submitted under paragraphs 4 or 5 for acquisition through Portions that are already surveyed to standards of Parts 4 or 6 of the Directions, the Authority shall be fully responsible for obtaining funds for cadastral surveys required. In each case, a letter advising that funds are available must accompany the plans. On receipt, instructions will be issued for cadastral surveys of the appropriate standard of the relevant portions, and the Authority will be advised of the estimated cost. Survey will be scheduled when funds are received.

An exception may be made, at the discretion of the Surveyor General, where the road crosses Government land that may be subject to future subdivision or is institutional land, and likely to remain so.

It should be noted that, although negotiations may take place with lessees based on the A or M plans, the actual acquisition cannot be finalised until the standard cadastral survey is completed and registered.

8. In all cases, at the completion of works, the Principal Surveyor of the Authority shall forward a Certificate advising that the works are wholly contained within the acquired area.

Should the construction go outside the reserve boundary, the Authority shall forward a new plan showing amended reserve. The part of the original abandoned area shall be cancelled.

However, it cannot be too strongly emphasised that going outside acquisition boundaries can lead to considerable difficulty at times and should be avoided at all costs.

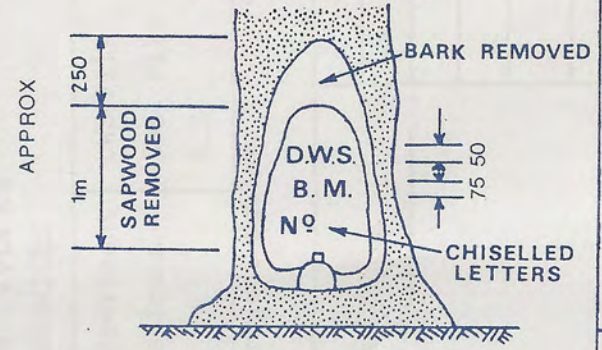
B J MENNIS
A/Surveyor General

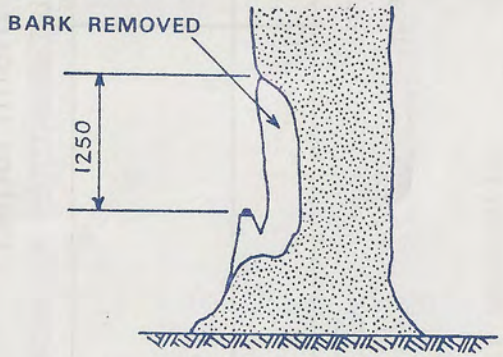
APPENDIX A

STANDARD SURVEY INSTRUCTION

NATURE AND DIMENSION OF MARKS

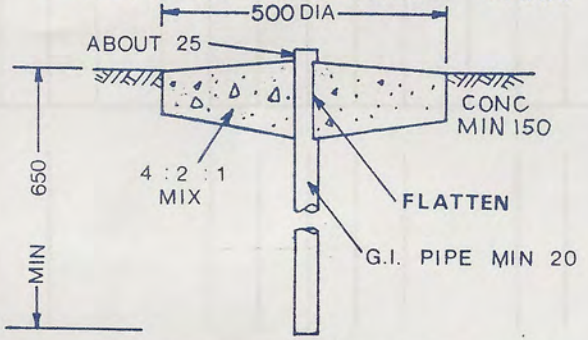
B.M. ON TREE
(MIN 600 DIAMETER)





NOT TO BE USED IN URBAN AREAS

(P.R.M.)
PERMANENT RECOVERY MARK



FIELD BOOK SYMBOLS

- TEMP TRAVERSE STATION OR I.P.
- SURVEY MARK (ANNOTATED AS APPICABLE E.G.: 'O.C.P.' 'S.P.K.' etc. IF MARK OTHER THAN PEG)
- PERMANENT SURVEY MARK
- BENCH MARK
- PERMANENT RECOVERY MARK

OTHER MARKS AS PER SURVEY CO ORDINATION REGULATIONS

DEPT. OF WORKS & SUPPLY

Papua New Guinea

Department of Works

STANDARD CLAIM FORM FOR SURVEYS

APPENDIX B 2

CONSULTANT	Department Estimate	File: Consul. File: 125-30- Consul. Ref:	
PROJECT	Project No.	Claim No.	Office Use Only
Surveyors.....hrs @ K			
Associates.....hrs @ K			
Survey Technician.....hrs @ K			
Draughtsmen.....hrs @ K			
Permanent Field Hands.....hrs @ K			
Labour.....Man Days @ K			
Camping Allowance.....days @ K			
Camping Allowance...Man days @ K			
Vehicle Allowance..... days @ K			
Vehicle Allowance.....Mileage @ K			
Fares (Attach coupons)			
Other costs (Attach details)			
PROGRESS CLAIMS APPROVED			

This Figure Authorised on Project_____

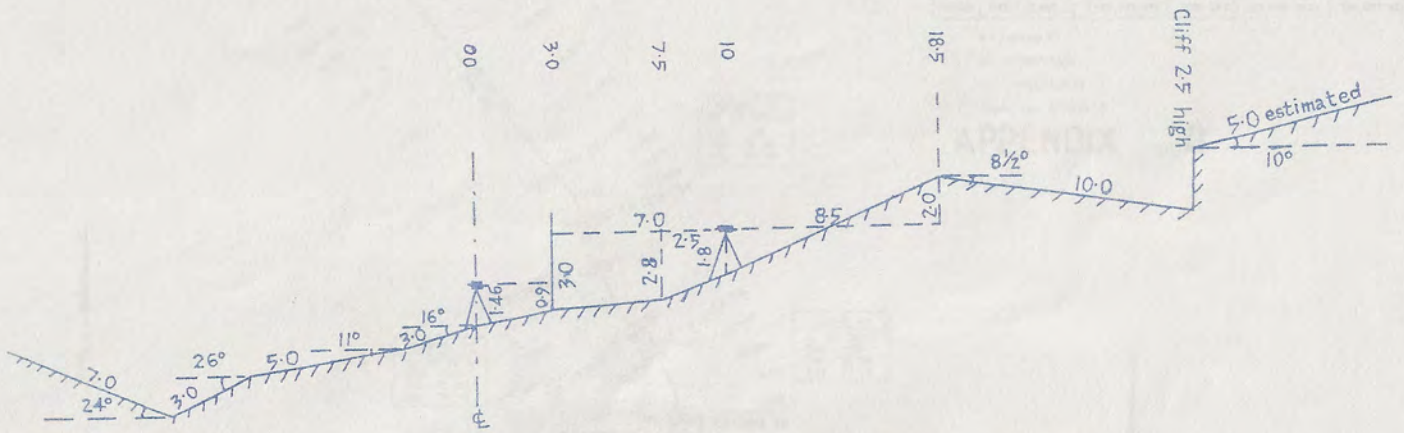
Please prepare cheque and return to Survey Section

Recommended_____ Approved_____

Project Surveyor Principal Surveyor

CONSULTANT

This form is to be completed in triplicate together with T.F.4 (also in triplicate). Accounts are to be submitted before the 20th of each month. One copy will be returned, showing deductions if any, together with a cheque for the amount. This should reach the consultants by the end of the relevant month. If not, please contact Dept of Works & Supply (Survey Section). Note that "Approved" amounts only are to be used when calculating payments due:
Any dispute on reductions should be subject to separate claim and explanatory letter and not included in subsequent claims on this or other projects.



Clino Example

Instrument & Clino Example

																	Folio		
Left								Centre Line	Right										
																	8°30′		
				+24°	−26°	−11°	−16°	1·46	0·9	/ 3·0	2·8	1·8	−2·0	−8½°	+90°	+10°			
				7·0	Δ 3·0	Δ 5·0	Δ 3·0	1400	3·0		7·5	10	18·5	Δ 10	Δ 2·5	Δ 5·0est			

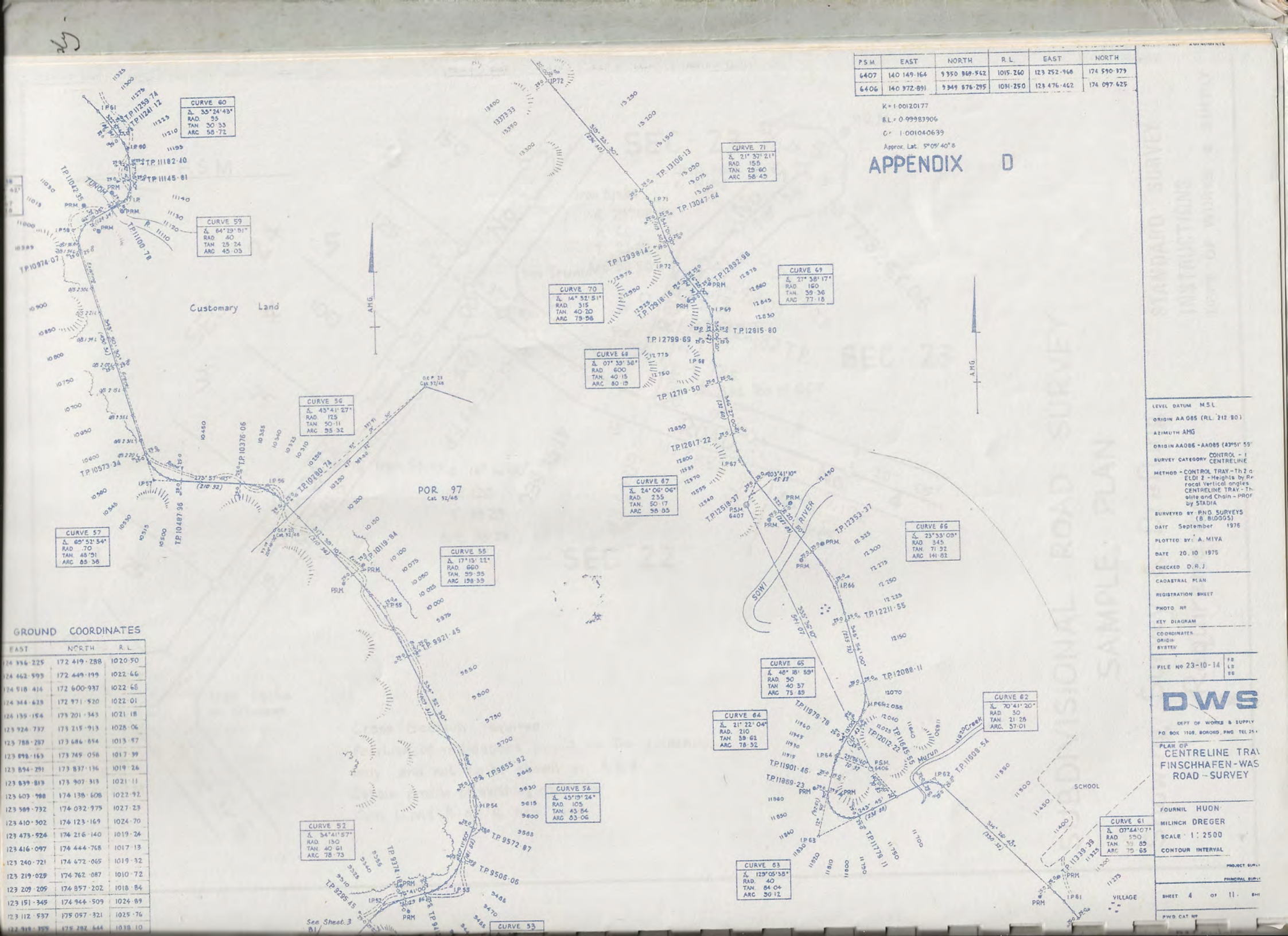
TWO METHODS OF CROSS SECTIONING

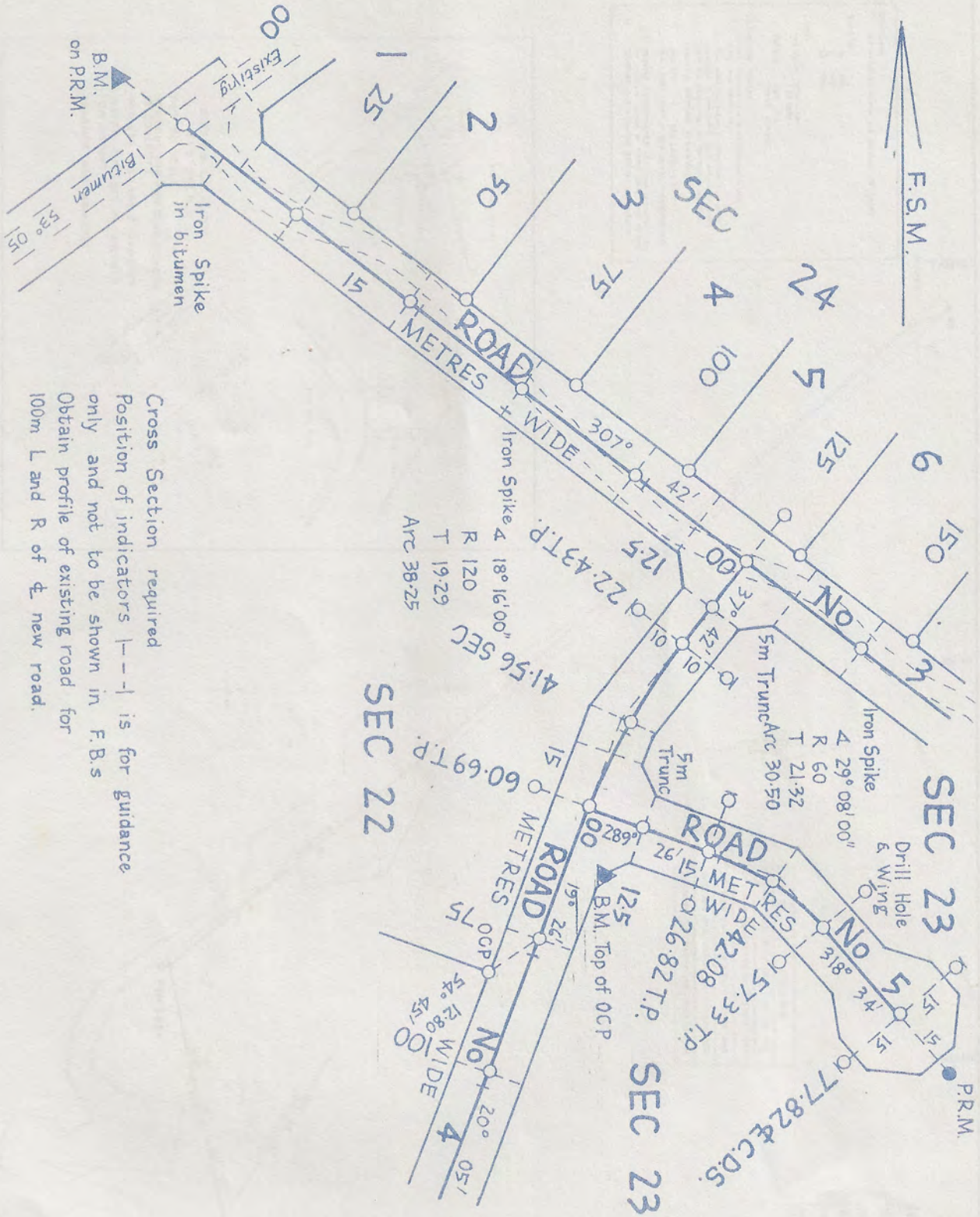
1. Difference in Height from Inst. Height with all distances reduced to horizontal and running chainage from centreline.
2. Clino angles with distances measured along each slope; clino reading must be taken from the point where the previous reading terminated.

A combination of the two methods, as shown in the example, is acceptable.

NOTE:

1. The Δ symbol must be used to mark zero chainages and the / symbol for datum shifts and change points.
2. If tailing off a cross section a distance must be given. This may be estimated.
3. All cross sections must be square to straights or radial to curves. At intersection points, the cross section must be square to back traverse line.
4. A cross section must be taken on both sides of the centreline.
5. If a centreline level is deemed necessary then a cross section must also be booked, however Surveyor can use noting "as for chainage.....". (giving chainage). This method can denote either one or both sides of centreline.
6. Where a bridge site survey (or similar) is to be carried out, it is essential to give complete centreline levels and cross sections as part of the through survey, even though a separate bri[illegible] site survey is carried [illegible]


P.S.M. | EAST | NORTH | R.L. | EAST | NORTH
6407 | 140 149·164 | 9 350 869·542 | 1015·260 | 123 252·968 | 174 590·979
6406 | 140 372·891 | 9 349 876·295 | 1091·250 | 123 476·462 | 174 097·625
K = 1·00120177
B.L. = 0·99983906
C = 1·00104·0639
Approx. Lat. 5°09'40"S
APPENDIX D
CURVE 60 Δ 35°24'43" RAD. 35 TAN. 30·33 ARC 58·72
CURVE 59 Δ 64°29'51" RAD. 40 TAN. 25·24 ARC 45·03
CURVE 57 Δ 65°52'54" RAD. 70 TAN. 48·51 ARC 85·36
CURVE 56 Δ 43°41'27" RAD. 125 TAN. 50·11 ARC 95·32
CURVE 55 Δ 17°13'22" RAD. 660 TAN. 99·93 ARC 198·39
CURVE 54 Δ 45°19'24" RAD. 105 TAN. 43·84 ARC 83·06
CURVE 53
CURVE 52 Δ 34°41'57" RAD. 130 TAN. 40·61 ARC 78·73
CURVE 71 Δ 21°37'21" RAD. 155 TAN. 29·60 ARC 58·45
CURVE 70 Δ 14°32'51" RAD. 315 TAN. 40·20 ARC 79·96
CURVE 69 Δ 27°38'17" RAD. 160 TAN. 39·36 ARC 77·18
CURVE 68 Δ 07°39'36" RAD. 600 TAN. 40·15 ARC 80·19
CURVE 67 Δ 24°06'06" RAD. 235 TAN. 50·17 ARC 98·85
CURVE 66 Δ 23°33'08" RAD. 345 TAN. 71·92 ARC 141·82
CURVE 65 Δ 48°18'59" RAD. 90 TAN. 40·37 ARC 75·89
CURVE 64 Δ 21°22'04" RAD. 210 TAN. 39·61 ARC 78·32
CURVE 63 Δ 129°05'38" RAD. 40 TAN. 84·04 ARC 90·12
CURVE 62 Δ 70°41'20" RAD. 30 TAN. 21·26 ARC. 37·01
CURVE 61 Δ 07°44'07" RAD. 550 TAN. 37·85 ARC 75·65
Customary Land
POR 97 Cat. 32/48
SOWI RIVER
Murun Creek
SCHOOL
VILLAGE
See Sheet 3
LEVEL DATUM M.S.L.
ORIGIN AA 085 (RL. 212·80)
AZIMUTH AMG
ORIGIN AA086 - AA085 (43°51' 59"
SURVEY CATEGORY CONTROL - 1 CENTRELINE
METHOD - CONTROL TRAV - Th 2 a ELDI 2 - Heights by Reciprocal Vertical angles CENTRELINE TRAV - Theolite and Chain - PROF by STADIA
SURVEYED BY PNG SURVEYS (B. BLOGGS)
DATE September 1976
PLOTTED BY A. MIYA
DATE 20.10.1976
CHECKED D.R.J
CADASTRAL PLAN
REGISTRATION SHEET
PHOTO No
KEY DIAGRAM
COORDINATES ORIGIN SYSTEM
FILE No 23-10-14
DWS
DEPT OF WORKS & SUPPLY
P.O. BOX 1108, BOROKO, PNG TEL 25
PLAN OF CENTRELINE TRAV FINSCHHAFEN-WAS ROAD - SURVEY
FOURNIL HUON
MILINCH DREGER
SCALE 1:2500
CONTOUR INTERVAL
SHEET 4 OF 11
PWD CAT No
GROUND COORDINATES
EAST | NORTH | R.L.
124 336·225 | 172 419·288 | 1020·50
124 462·593 | 172 449·199 | 1022·66
124 518·414 | 172 600·937 | 1022·68
124 344·623 | 172 971·520 | 1022·01
124 139·154 | 173 201·343 | 1021·18
123 924·737 | 173 215·913 | 1028·06
123 788·287 | 173 686·854 | 1013·57
123 898·163 | 173 749·058 | 1017·39
123 894·291 | 173 837·136 | 1019·26
123 839·813 | 173 907·313 | 1021·11
123 603·788 | 174 138·608 | 1022·92
123 589·732 | 174 032·975 | 1027·23
123 410·302 | 174 123·169 | 1024·70
123 473·524 | 174 216·140 | 1019·24
123 416·097 | 174 444·768 | 1017·13
123 240·721 | 174 672·065 | 1019·32
123 219·029 | 174 762·087 | 1010·72
123 209·209 | 174 857·202 | 1018·84
123 151·349 | 174 944·509 | 1024·89
123 112·537 | 175 057·321 | 1025·76
123 319·359 | 175 282·644 | 1038·10



SUBDIVISIONAL ROAD SURVEY
SAMPLE PLAN
Showing Survey & Drafting Requirements

STANDARD SURVEY INSTRUCTIONS
DEPT. OF WORKS & SUPPLY

Distances
All distances shown are GROUND DISTANCES

Symbols
- PRM
- OCP
- PSM

Closes
Horizontal C318 - 321 1:63 000
Vertical C318 - 314 0·044 9·6km

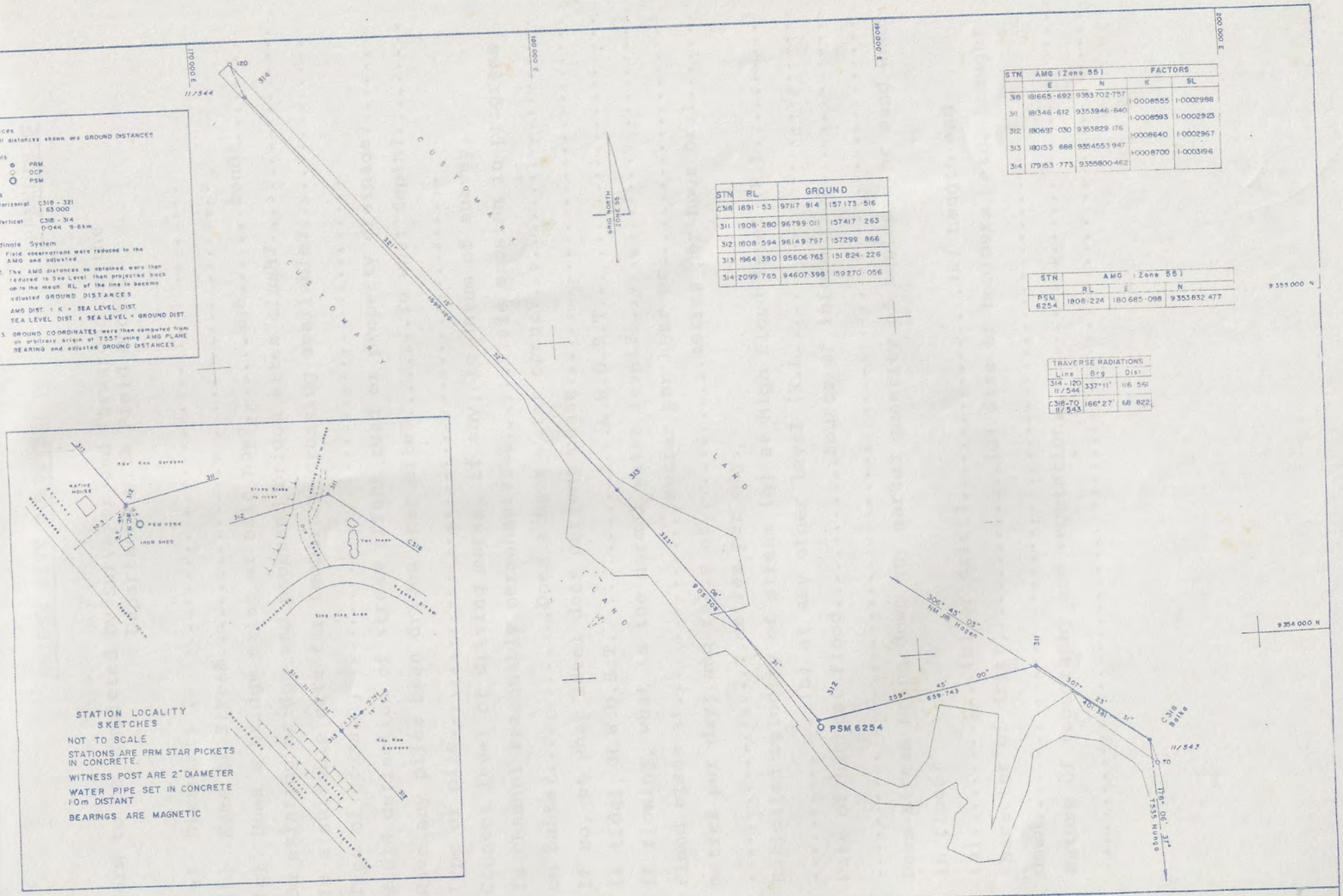
Coordinate System
1. Field observations were reduced to the AMG and adjusted
2. The AMG distances so obtained were then reduced to Sea Level then projected back up to the mean RL of the line to become adjusted GROUND DISTANCES
   AMG DIST ÷ K = SEA LEVEL DIST.
   SEA LEVEL DIST x SEA LEVEL + GROUND DIST.
3. GROUND COORDINATES were then computed from an arbitrary origin at T557 using AMG PLANE BEARING and adjusted GROUND DISTANCES

STN	AMG (Zone 55) E	AMG (Zone 55) N	FACTORS K	FACTORS SL
316	181665·692	9353702·757	1·0008555	1·0002988
311	181346·612	9353946·640	1·0008593	1·0002925
312	180697·030	9353829·176	1·0008640	1·0002967
313	180153·688	9354553·947	1·0008700	1·0003196
314	179153·773	9355800·462		

STN	GROUND RL	GROUND E	GROUND N
C318	1891·53	97117·914	157173·516
311	1908·280	96799·011	157417·263
312	1808·594	96149·797	157299·866
313	1964·390	95606·763	151824·226
314	2099·765	94607·398	159270·056

STN	AMG (Zone 55) RL	E	N
PSM 6254	1808·224	180685·098	9353832·477

TRAVERSE RADIATIONS Line	Brg	Dist
314 - 120 11/544	337°11'	116·561
C318-70 11/543	166°27'	68·822



LEVEL DATUM MSL
ORIGIN C318 Baika - 1891·53
AZIMUTH DATUM AMG
ORIGIN C318 Baika - T535 Nunga
1783·06 324

PROVINCE WESTERN HIGHLAND
FOURMIL RAMU
MILINCH HAGEN
FIELD BOOK
SURVEY CATEGORY 1

I M VERRAN hereby certify that the above survey has been carried out by me or under my direct supervision, and is a true and accurate representation of field-work carried out. The survey complies in all respects with the Standard Survey Instructions, October 1981, and all amendments thereto

SURVEYED BY M.VERRAN
DATE AUGUST 1980
PLOTTED BY WILLIAM
DATE DEC. 1980
CHECKED BY M.VERRAN

DWS
DEPT OF WORKS & SUPPLY
P.O. BOX 1100, BOROKO, PNG TEL 25 6666

APPROVED:
PROJECT SURVEYOR
PRINCIPAL SURVEYOR
REGIONAL FILE No.
H.Q. FILE No. 28 - 20 - 02
OFFICE
REFERENCE 11/543

PLAN OF
ENGA HIGHWAY
CONTROL SURVEY
C318 — PRM 314

SCALE 1:5000
SHEET 3 OF 13 SHEETS
SIZE A1 SAMPLE
NUMBER

BRIDGE SITE SURVEYS — APPENDIX G

Form to be completed by Surveyor and forwarded to the Department with Field Books.

1. (a) District: .. ..
   (b) Name of Stream.....
   (c) Does a bridge exist at site now?.....age.....condt.....
2. Do existing bridge and proposed bridge sites clash?.....
   Is a suitable site for temporary crossing available?.....
   Type of crossing.....
3. Would deflection of stream affect road or property drainage?.....
4. Have any piles been driven near site?.....To what depth?.....
   Type of pile.....
   Connect level of driving marks, if any, to datum of survey.
5. Is channel reasonably permanent?.....Is erosion in progress on banks?.....Does a back water occur?.....
   If so, at what level does current cease?.....
6. If tidal, H.W.O.S.T.....L.W.O.S.T.....
7. If flowing, what is the normal water level?.....
8. Flood rises at.....metres per hour or.....
   metres per day; and falls at.....metres per hour or.....
   .....metres per day.
9. Estimated velocity of stream (a) at high flood level (R.L.....)
   .....(b) at any other level (R.L.....) - .....
10. Date of highest flood.....Source of information.....
    .....
11. Does stream bring down any marked quantity of boulders or sand when in flood?
    (a).....(b) or drift?.....(c) Length and character of drift.....(d) Size of boulders, etc. brought down.....
12. Nature of topography and vegetation.....
    .....

DEPARTMENT OF WORKS

SURVEY SECTION

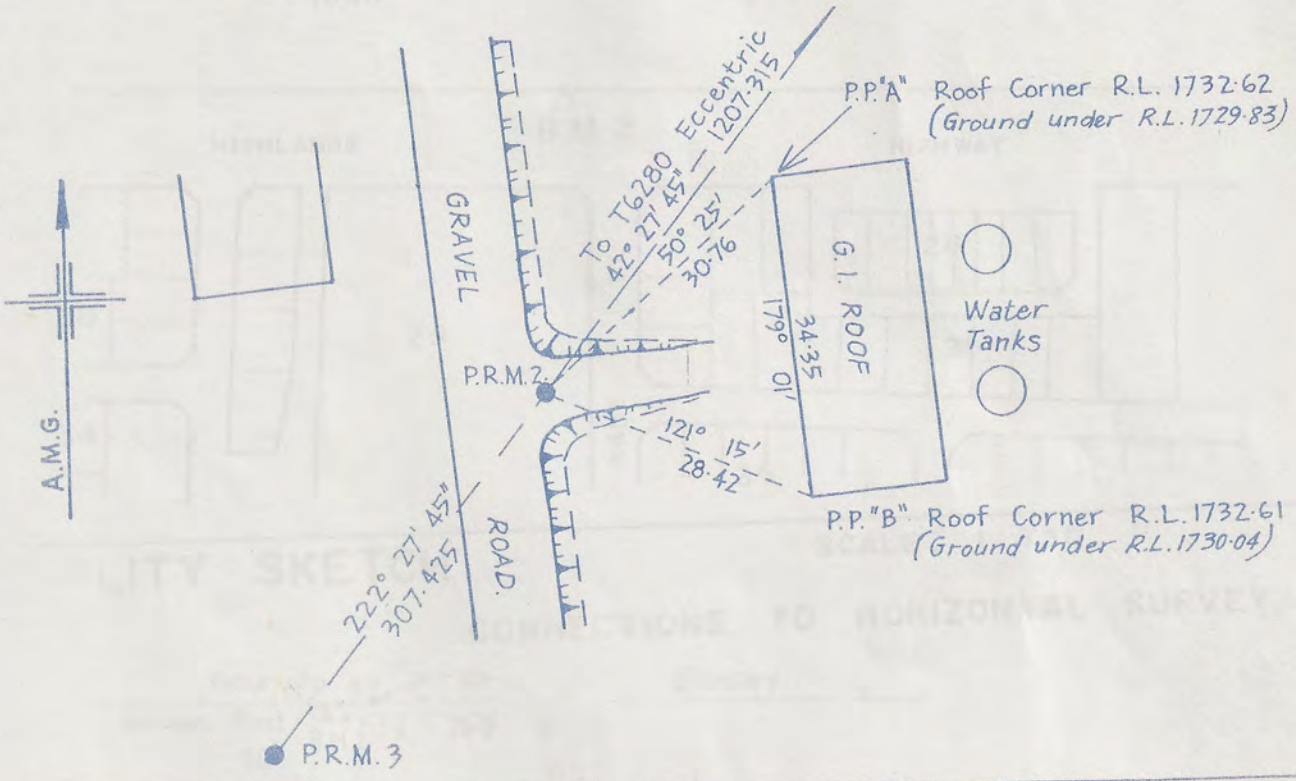
APPENDIX H

PHOTO CONTROL POINT DATA

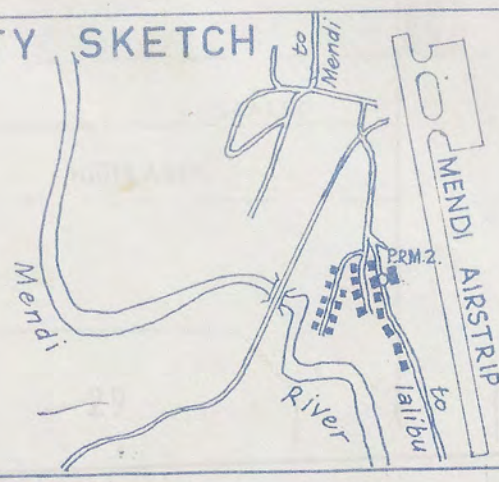
PROJECT	FILE Nº	POINT Nº	FIELD BOOK	ESTABLISHED BY: D.W.S.	DATE
MENDI AIRSTRIP	SS 21-06-02	P.R.M. 2	2629		Nov 1970
REF. CO-ORDINATES A.M.G.	MILINCH MENDI	FOURMIL KUTUBU	EASTING 827878·82	NORTHING 9093803·47	R.L. 1728·90

GROUND MARK: G.I.P. SET IN CONC. POURED INSITU
SURVEY DETAILS: Distomat radiation & simultaneous reciprocal vert. obs. from T6280 Ecce.
AIR PHOTO REF.: QASCO Film no N.G.125 Run no 1 Frame 7433
LOCATION & ACCESS: Approx 0·8 Km along lalibu road from TOWN CENTRE - on west side Airstrip
VERTICAL DATUM: T.6280 - R.L. 1742·54
CO-ORD DATUM: T6280 - N 9094691·18 E 828698·89

STATION SKETCH



LOCALITY SKETCH



10mm
15mm

TITLE STRIP

REMARKS

SAMPLE ONLY

Folio No.

DEPARTMENT OF WORKS

SURVEY SECTION APPENDIX I1

BENCH MARK DATA (URBAN)

PROJECT	FILE Nº	B.M Nº	FIELD BOOK	ESTABLISHED	DATE
KAINANTU ROADS		2	Vol. 1 Fol. 19	BY: J.M.HARRIS	30-7-71
	MILINCH	FOURMIL	ORDER	DATUM MSL	R.L
	KAINANTU	MARKHAM	CATEGORY 1	ORIGIN PSM 7737c	1572·743m

GROUND MARK : Steel Bolt in Conc. marked D.W.S.-B.M(Fenced) 6"x 6" Hardwood Witness Post.

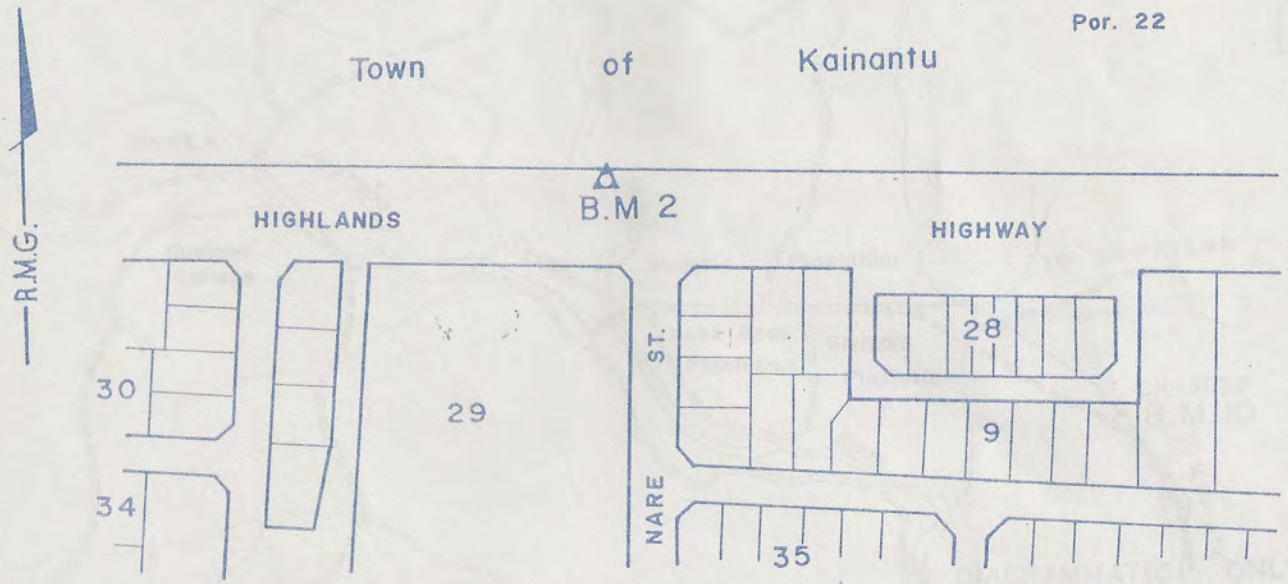
SURVEY DETAILS :

AIR PHOTO REF :

LOCATION & ACCESS : HIGHLANDS HIGHWAY

STATION SKETCH

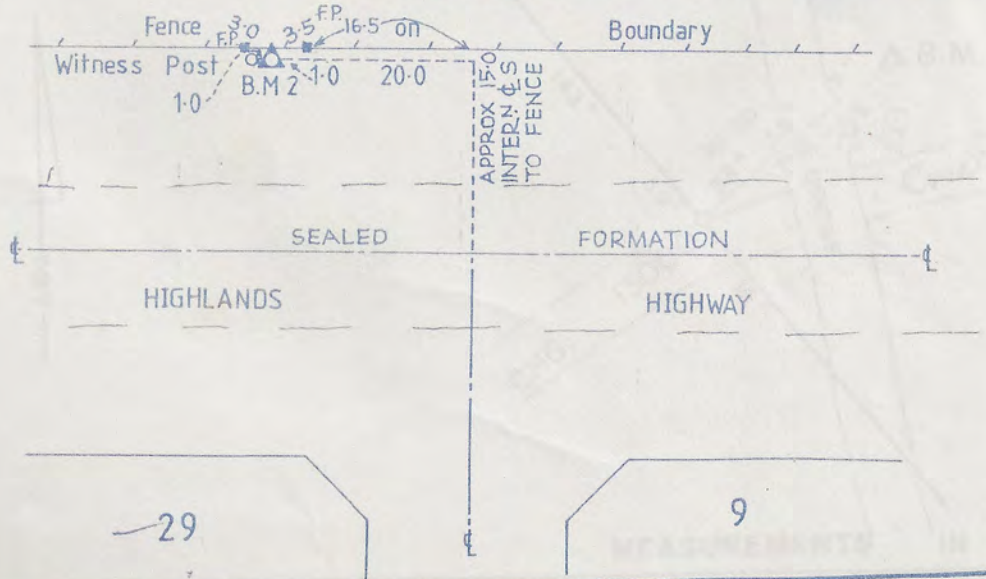
SCALE : 1:3000 Approx.



LOCALITY SKETCH

SCALE : 1 : 750

CONNECTIONS TO HORIZONTAL SURVEY.



REMARKS

SAMPLE ONLY

DEPARTMENT OF WORKS

SURVEY SECTION APPENDIX I 2

BENCH MARK DATA (RURAL)

PROJECT	FILE Nº	B.M Nº	FIELD BOOK	ESTABLISHED BY: G. ARMAN	DATE
EASTERN PAPUA H/W	18 / 70	10	3277		MAY'1971
	MILINCH	FOURMIL	ORDER	DATUM MSL	R.L
	RIGO	MORESBY	THIRD	ORIGIN PSM 10056	36·258

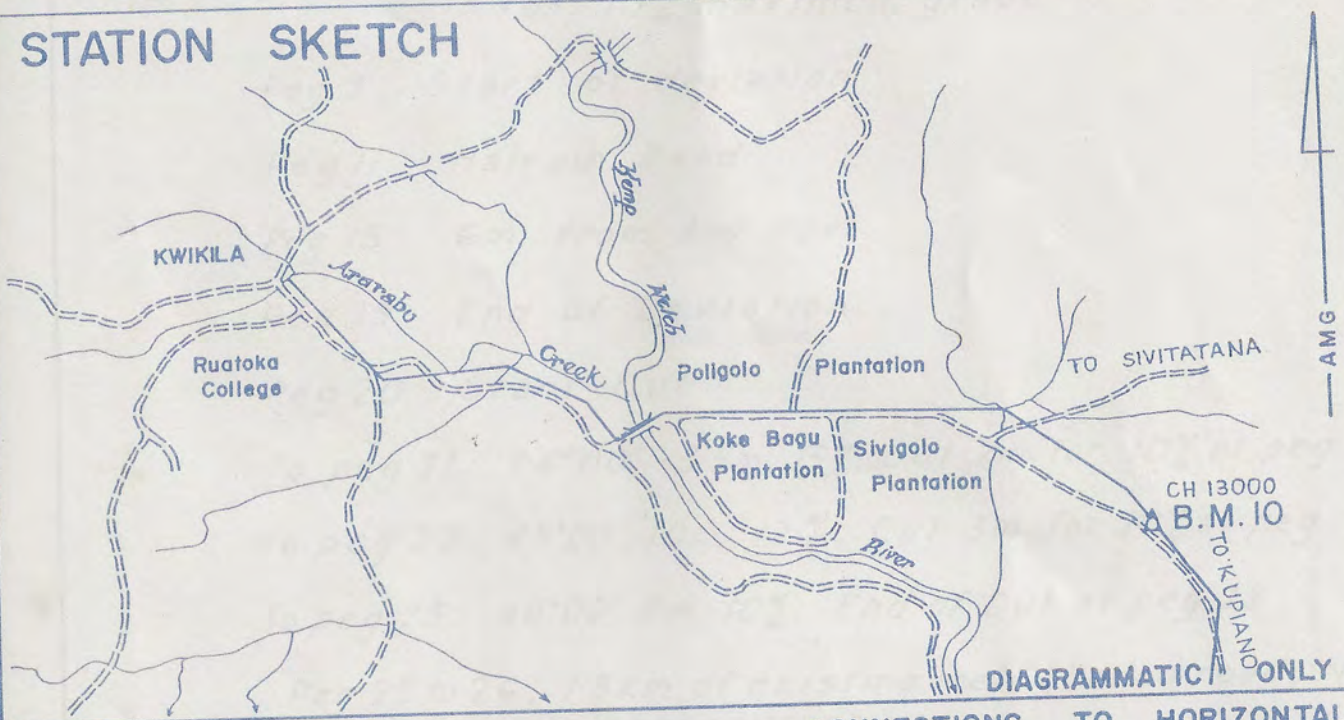
GROUND MARK: Steel Bolt in Conc. marked D.W.S. - B.M (Fenced) 6"x6" Hardwood Witness Post.

SURVEY DETAILS:

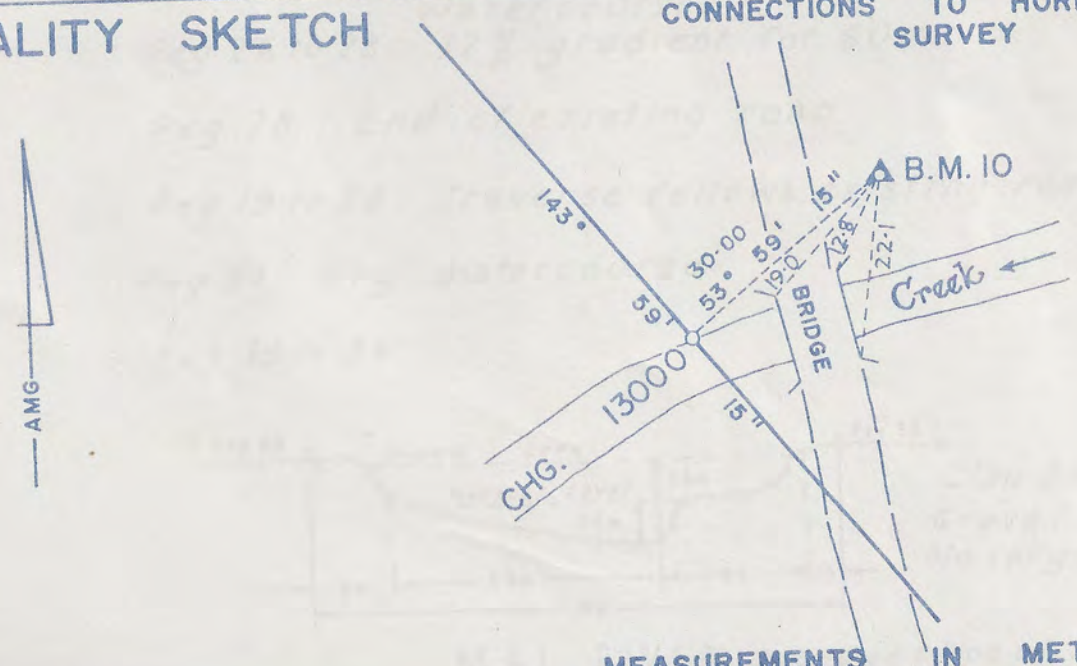
AIR PHOTO REF:

LOCATION & ACCESS: MAGI HIGHWAY

STATION SKETCH



LOCALITY SKETCH



REMARKS

SAMPLE ONLY

STANDARD SURVEY INSTRUCTIONS APPENDIX J

SAMPLE PAGE RURAL DEVELOPMENT

ROAD SURVEY

Category One

Peg 1 : On existing road 6km. from Nipa

Peg 2 : Water course 3m. bank to bank 1m. waterway 1m. deep.

Peg 1 to 9: Traverse follows existing road. Grades to be evened out between pegs for 10% maximum grade

Peg 9 : Start of deviation

Peg 11: Hairpin Bend.

Peg 15: 6m. from Aid Post

Peg 19: End of Deviation

Peg 20: Start Cut

To peg 21: 34°00', 3·5m, 15%. Cut 2m for 10% at peg

To peg 22: 45°00', 10m, 12%. Cut 3m. for 10% at peg

To peg 23: 40°00', 3m, 10%. End of Cut at peg 23

Peg 25 to 26 : 1·8km. of existing well graded road. No watercourses

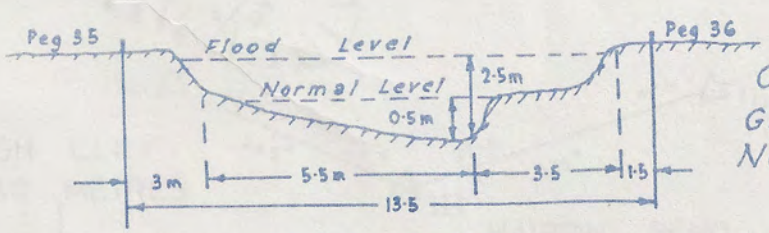
Peg 26 to 28 : 12% gradient for 60m.

Peg 28 : End of existing road

Peg 19 to 28 : Traverse follows existing road

Peg 31 : Dry watercourse

Peg 35 to 36 :



Clay Banks
Gravel Bed
No large stones

MAI RIVER average slope of River bed 2°30

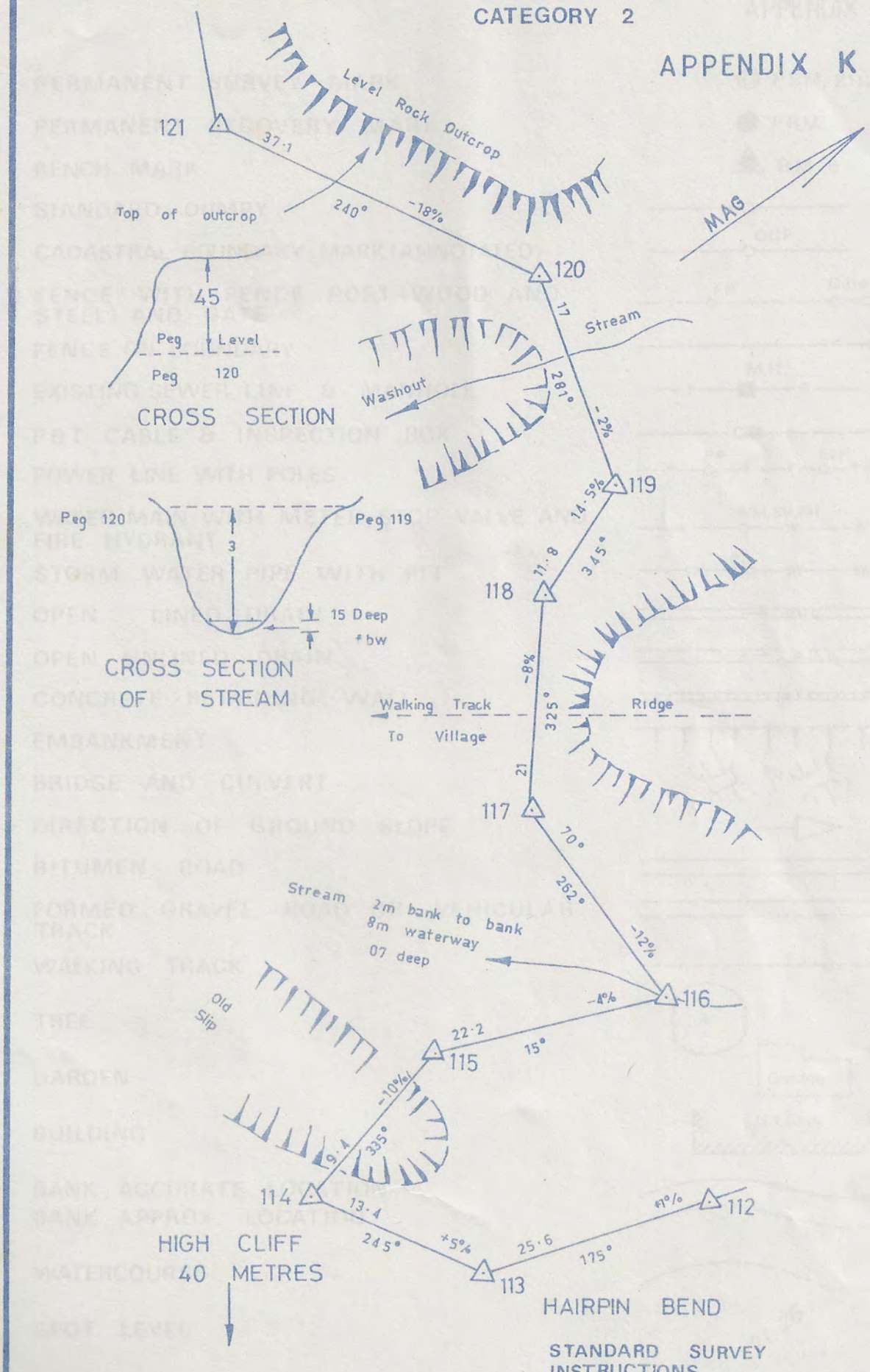
Peg 36 : End of Survey

STANDARD SURVEY INSTRUCTIONS
DEPT. OF WORKS

SAMPLE PAGE RURAL DEVELOPMENT ROAD SURVEY

CATEGORY 2

APPENDIX K



STANDARD SURVEY INSTRUCTIONS

DEPT. OF WORKS

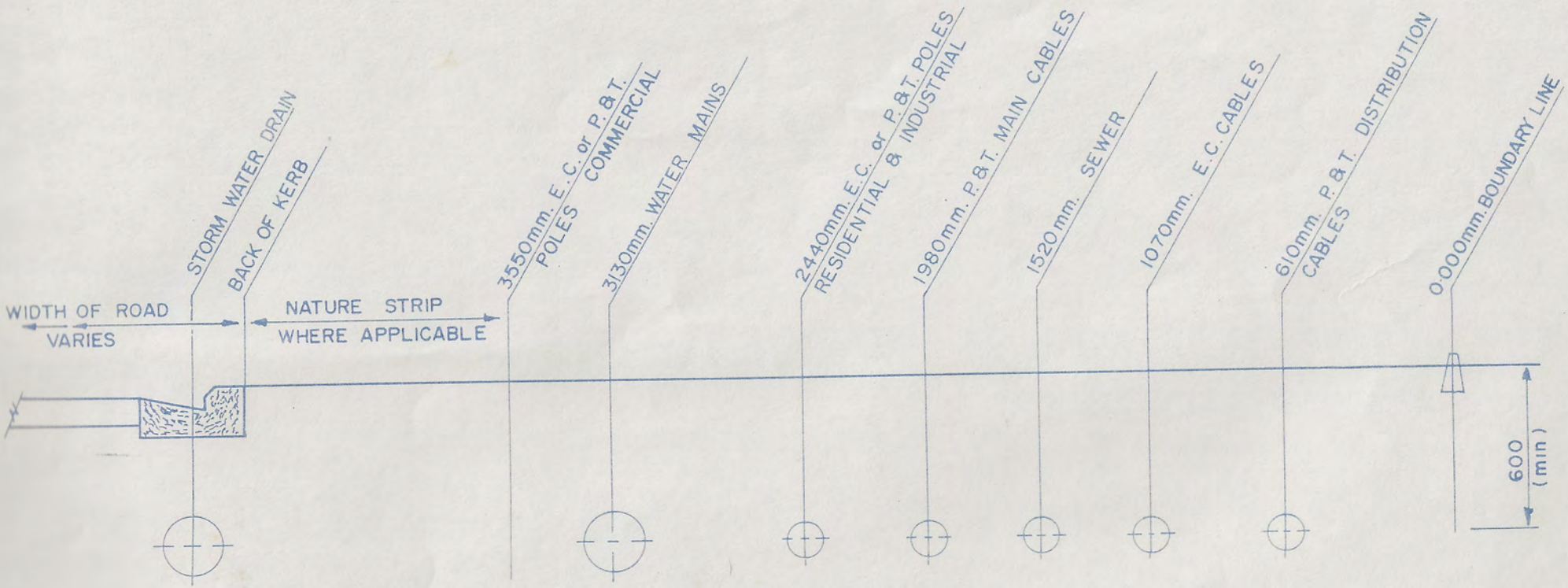
STANDARD SYMBOLS

APPENDIX L

PERMANENT SURVEY MARK	◎ P.S.M. 2112
PERMANENT RECOVERY MARK	● P.R.M.
BENCH MARK	▲ B.M. 6
STANDARD DUMPY	
CADASTRAL BOUNDARY MARK (ANNOTATED)	O.C.P.
FENCE WITH FENCE POST (WOOD AND STEEL) AND GATE	F.P. Gate
FENCE ON BOUNDARY	
EXISTING SEWER LINE & MANHOLE	M.H. S S S
P&T CABLE & INSPECTION BOX	P&T
POWER LINE WITH POLES	PP ELP P P P P
WATER MAIN WITH METER, STOP VALVE AND FIRE HYDRANT	WM,SV,FH W W W
STORM WATER PIPE WITH PIT	Pit SW SW SW
OPEN LINED DRAIN	O.L.D.
OPEN UNLINED DRAIN	O.U.D.
CONCRETE RETAINING WALL	
EMBANKMENT	
BRIDGE AND CULVERT	
DIRECTION OF GROUND SLOPE	
BITUMEN ROAD	
FORMED GRAVEL ROAD OR VEHICULAR TRACK	
WALKING TRACK	
TREE	
GARDEN	Garden
BUILDING	G.I. Shed
BANK, ACCURATE LOCATION BANK, APPROX. LOCATION	
WATERCOURSE	
SPOT LEVEL	21.26

Where a symbol is not shown hereon, then refer to the Survey Directions 1980

DEPT. OF WORKS



STANDARD ENGINEERING SERVICE ALIGNMENTS

APPENDIX "

Papua New Guinea

Department of Works

APPENDIX B1

STANDARD CLAIM FORM FOR PHOTOGRAMMETRIC SERVICES

CONSULTANT	Department Estimate	DWS File Con. File S.S.
PROJECT	Project Number	Office Use only

AERIAL PHOTOGRAPHY		
Flying Time _____ hrs @ K _____		
or Lump Sum quote		
Stand by Time (if applicable)		
STEREO TRIANGULATION		
Preparation, Observation & Recording		
Data Preparation Models ____ @ K _____		
Data Processing at cost		
STEREO PLOTTING		
Models _____ @ K _____		
Hectares (0%-10%) _____ @ K _____		
Hectares (10%-20%) _____ @ K _____		
Hectares (over 20%) _____ @ K _____		
Improvements _____ @ K _____		
BASE SHEET		
Preparation and Data Plotting hrs____ @ K _____		
Fair Drawing hrs____ @ K _____		
MISCELLANEOUS		
Digital Measurements _____hrs @ K _____		
Misc. Stereo-Plotting _____hrs @ K _____		
Other Cost (attach details)		
PHOTOGRAPHY		
Prints _____ @ K _____		
Negatives _____ @ K _____		
Diapositives _____ @ K _____		
TOTAL COST		

ACCOUNTANT

This figure Authorized on project No._____ _____