Appendix X – Manual for the Production of Construction Drawings, City of Winnipeg, Works and Operations Division, November 1984

MANUAL FOR THE PRODUCTION OF CONSTRUCTION DRAWINGS

THE CITY OF WINNIPEG

WORKS AND OPERATIONS DIVISION

NOVEMBER 1984

1984 11 22

Directors of:

Waterworks, Waste & Disposal Department
Streets & Transportation Department
Operations Department

In January of 1980, the General Guidelines for the Production of Construction Drawings for the Works and Operations Division were introduced to give direction to the consulting engineering firms as well as to the City's in-house design groups. Considering the number and variety of offices involved, the need for drawing standards was obvious. Since the initial development of the guidelines, a recent review has been made, and the result is this revised and updated manual.

Effective immediately it will be the policy of the Works and Operations Division to implement this Manual for the production of Construction Drawings as they relate to Municipal Services.

All drawings, whether they are produced by a City Department, or by a consulting firm for a developer or for the City, must strictly adhere to the standards specified in this Manual without exception.

Thank you for your co-operation in the matter.

Yours truly,

R. J. McRae, P. Eng.,
Commissioner of Works and
Operations

Any questions regarding the content of this manual should be addressed to the following Committee members.

R. Robert, Supervisor of Drafting Services	- Works and Operations Division Streets and Transportation Department
L. Martynec, Supervisor of Underground Structures and Microfilm Services	- Works and Operations Division Streets and Transportation Department
A. Kelly, Supervisor of Drafting	- Works and Operations Division Waterworks, Waste & Disposal Department
T. Chuback, Supervisor of Technical Services	- Works and Operations Division District #4 Operations Department

TABLE OF CONTENTS

PAGE

Part 4 Requirements for the Production of Drawings

PART 1

DRAWING FORMAT

Drawings vs. Specifications

The purpose of The City of Winnipeg Works and Operations Division's Drafting Standard Manual is to establish the minimum criteria for the production of construction drawings relative to all municipal services which ultimately fall under the jurisdiction of The City of Winnipeg.

The intent of drawings in a construction contract is to define the physical relationships of materials upon which the contract is based.

A common goal of the City Departments is to keep the drawings simple and understandable. A contractor using such drawings working in the field deals with many problems, and any misinterpretation of a complex drawing is not only costly to his company but to the City as well.

In the past, redundant information was prevalent in most construction drawings. Therefore, it is desirable that the information should be given once and shown in the most logical place. All other locations in contract drawings, where the information can be shown, should be cross-referenced to the original statement.

Specifications define quality and types of workmanship and materials, whereas drawings define the physical relationships of materials. Only one type of material should be shown on the drawing, even though alternatives may be allowed by the specification. The dimension to the location must be carefully indicated to show the physical relationship of materials. (Material is identified in the specifications by generic terms, e.g. - asphaltic concrete as specified in CW 3410-R2).

The drawings shall state a certain material to be used. The questions on the guarantees and installation methods, or "quality and types of materials" are best handled by the specifications and approval by the project engineer. Therefore, the following is recognized:

- The specifications generally govern any differences between drawings and specifications.
- The specifications should be used wherever possible to reduce notes on the drawings.
- Brand names of products should be used in the specifications only, and not on the drawings.
- The specifications should cover workmanship, and the construction drawings should show extent and quantity.
- Drawings and specifications should be complementary to each other.

The analyses of these simple measures, "physical relationship of materials" and "quality and types of materials" should dictate whether the data is shown in drawing or specification form.

Drawing Sheet Sizes

The standard drawing sheet sizes are based on an international agreement reached in the early twenties. The International Standards Organization (ISO) developed a series of sizes for paper and printed matter known as the A, B, C, and D Series. The "D" series was dropped altogether in 1928 and by 1934 it became obvious that the "B" series was required only for certain specialized purposes. The "C" series was retained primarily for envelope sizes to accommodate the "A" series of paper.

The "A" series of paper sizes is a rationally designed system based on a sheet having an area of 1 m^2 (841 x 1189 mm) from which all other sizes are derived by successively dividing it into two equal parts parallel to the shorter side (Figure 1). Consequently, the ratio of the areas of any two successive sheets is 2:1 and the ratio between the short side x and the long side y, of any sheet, is $1:\sqrt{2}$, i.e., the ratio between a side and the diagonal of a square (Figure 1).

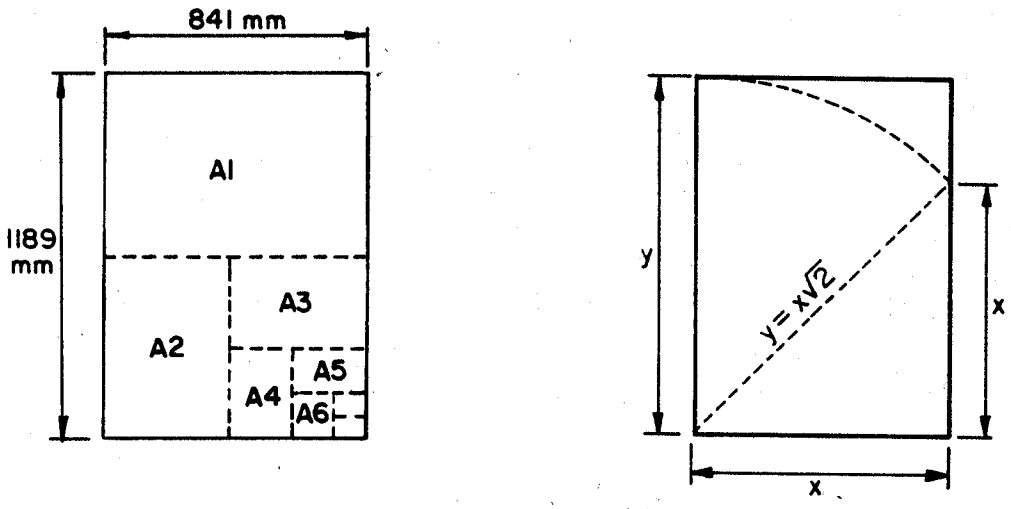


Figure 1

ISO "A" series for drawing sheets are shown in Table 1. Sheet sizes are designated by "A" followed by a number indicating the number of divisions that have been made. For example, A0 is the basic sheet, A4 is produced from the basic sheet by four successive divisions.

Designation	Dimensions, mm
A0	841 x 1189
* A1	594 x 841
A2	420 x 594
A3	297 x 420
A4	210 x 297

Table 1

*** The City of Winnipeg Standard Drawing Sheet Size**

Borders

Dimensions for the drawing frame shown in Table 2 below are adapted from the Manual on Metric Building Drawing Practice prepared by the National Research Council of Canada, N.R.C.C. 15234 revised January, 1977. The line thickness for border lines is 1 mm.

Drawing Sheet Size Designation	Nominal Width of Borders, mm			Dimensions of Rectangular Drawing Frame, mm
	On Top and Bottom	On LHS	On RHS	
A0	20	40	16	801 x 1133
A1	14	28	12	566 x 801
A2	10	20	8	400 x 566
A3	7	20	6	283 x 394
A4	7	20	6	283 x 184

TABLE 2

Preprinted Drawing Sheets

Preprinted drawing sheets at the A1 size (594 x 841 mm) are available for use by consulting firms from the various engineering offices of the Works and Operations Division. These sheets of polyester draughting film come in the following formats:*

(a) Cover Sheet Form No. WO 100-84
(b) Plan-Detail Sheet Form No. WO 101-84
(c) Plan-Profile Sheet Form No. WO 102-84
(d) Detail-Profile Sheet Form No. WO 103-84

Preprinted sheets for District Operations projects include a legend, while those produced for projects initiated by the Waterworks, Waste and Disposal Department and the Streets and Transportation Department do not.

The legends in the latter cases are to be handled by stick-ons applied to the back of the drawing sheet. Appropriate "stick-on" legends for most applications will be available from the initiating agency.

*** Polyester drafting film is commonly known by various trade names. i.e. mylar, dylar, etc.**

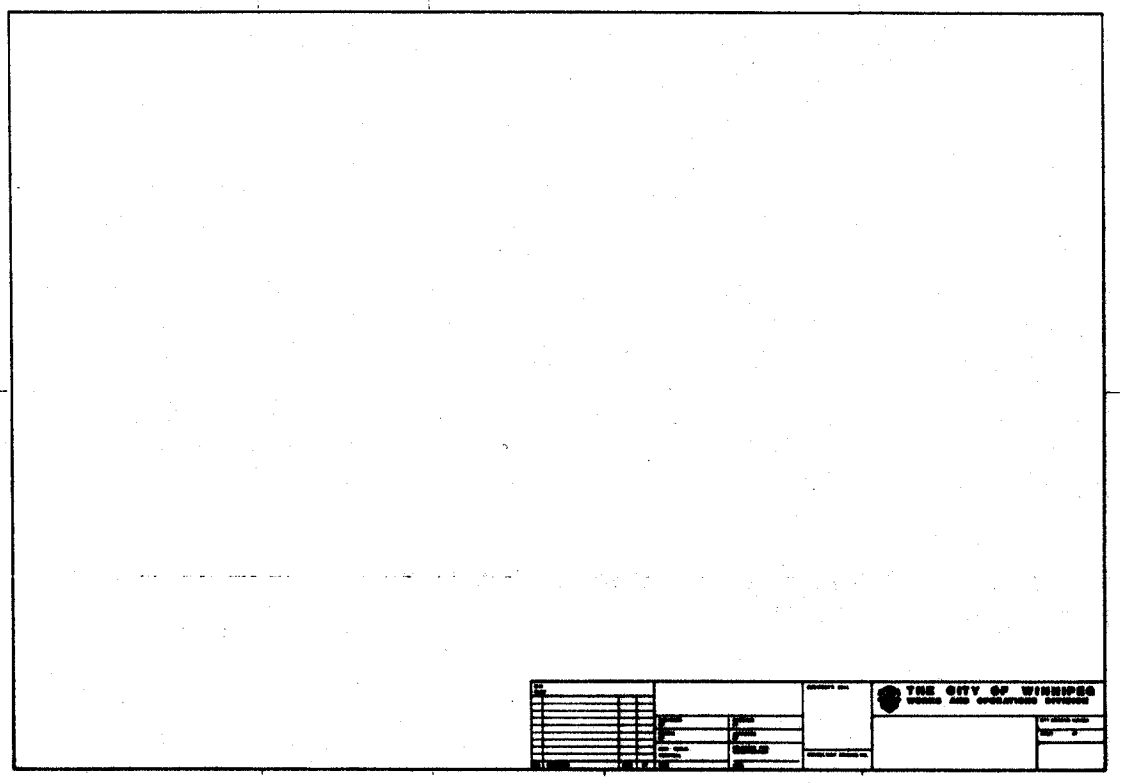
WO 100 - 84

CITY OF WINNIPEG

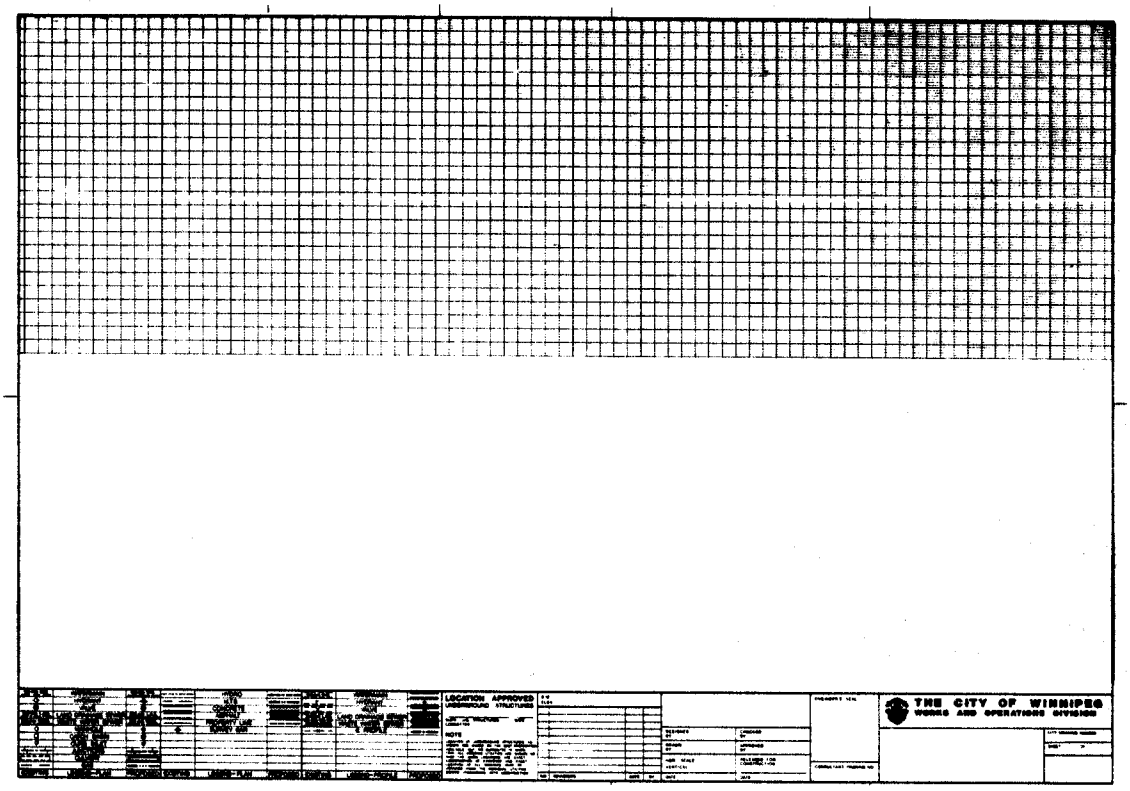
WORKS AND OPERATIONS DIVISION

P.D. NO.

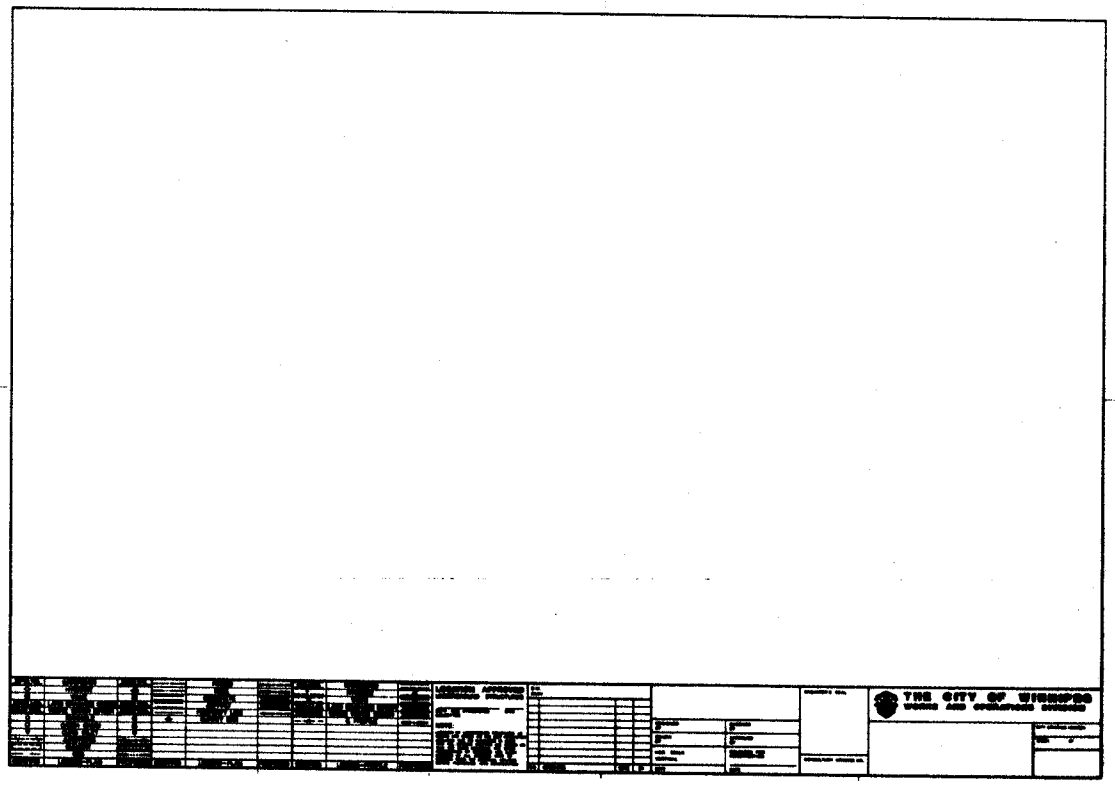
WO 101 - 84



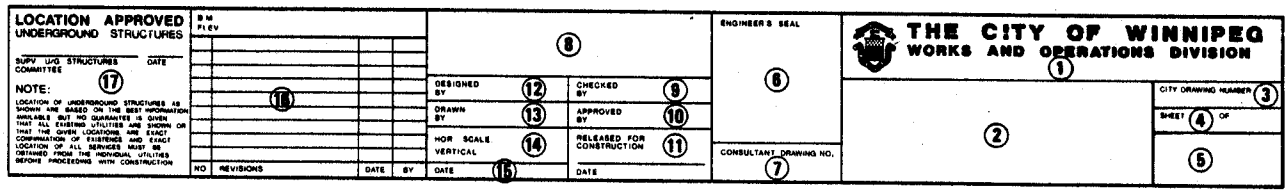
WO 102 - 84



WO 103 - 84



The Information Panel



All preprinted drawing sheets, except the title sheet, employ a horizontal information panel containing the following items:

1. **City of Winnipeg Identification** - Sheets produced for the Works and Operations Division include the City of Winnipeg crest and Works and Operations Division title. A space directly below the Works and Operations Division title is left to identify the relevant Department or District. The size of the letters shall be helvetica medium 20 point.

2. **Drawing Title Area** - The title area for the drawing showing the municipal service installation shall consist of three parts: street, specific location on that street and description of work, i.e.;

   Hamelin Street
   Chevrier Avenue - Clarence Avenue
   200 mm R.C. Pavement Reconstruction

DRAWING IDENTIFICATION SECTION

3. **City Drawing Number** - Drawings originating from City Departments shall use a Drawing number from their own filing system as required by the individual department. Note: A Drawing number may not be used in all cases.

   Consulting Firms preparing drawings for any of the Departments within the Works and Operations Division must use numbers obtained from the initiating Department's filing system which will be supplied on request.

4. **Sheet Identification** - Identifies the sheet number and the total number of sheets in the set, i.e. 3 of 12. The size of numbers shall be helvetica medium 20 point.

5. **Supplemental Drawing Identification** - This area may be used, as required, for supplemental drawing identification requirements by a City Department. This could include a "Standard Detail" Drawing Number or a "Contract" Drawing Number (where there is a requirement by the Department to have same different from the City Drawing Number).

DESIGN SECTION

6. **Engineer's Seal** - Space is provided for the Seal of the Engineer who is responsible for the design. Additional seals shall be placed outside the information panel.

7. **Consultant Drawing Number** - Drawings originating from a consulting firm will have a drawing number from their own filing system.

8. **Consultant's Identification** - A space is left for the consultant's name and crest. In the case of an "in-house" project, the district or engineering section shall be indentified in this space, i.e.;

   Streets and Traffic Branch
   Streets Construction and Bridges Section
   Bridge Sub-section

9. **Checked By** - Understood to mean drafting and design have been checked by the undersigned.

10. **Approved By** - Understood to mean approval of the design by the engineer in charge of the project at the consulting firm or at the City Design Office.

11. **Released for Construction** - The date and signature of the appropriate City official from the initiating City Department.

12. **Designed By** - Initials of designing engineer or technologist.

13. **Drawn By** - Initials of drafting technician.

14. **Scale** - Horizontal and vertical scale shall be noted in the information panel. Detail scale shall be noted on each detail sketch.

15. **Date** - Date that drawing was completed.

REVISION SECTION

16. **Revision Block** - Shall include the number of the revision, brief description of the revision, date revision completed and the initials of the Engineer (or his designate) who originally approved the drawing.

UNDERGROUND STRUCTURES SECTION

17. **Underground Structures** - Approval and waiver shall be included in the information panel of the plan-profile sheet as per the Underground Committee Agreement January 1, 1974. Note that:

Locations of underground structures as shown are based on the best information available, but no guarantee is given that all existing utilities are shown or that the given locations are exact. Confirmation of existence and exact location of all services must be obtained from the individual utilities before proceeding with construction.

NOTE: The Underground Structures Approval and Waiver will not be included in the information panel of the plan-detail sheets. The Underground Structures Department will affix their stamp as required.

Folding Prints

Two different methods of folding the ISO "A" series of drawing sizes have been illustrated in Figures 2 and 3. The method chosen will of course depend on what type of filing system is in use. Drawings preferably should be file folded. The preprinted contract sheets (A1 size) will have fold marks in the border area to facilitate file folding.

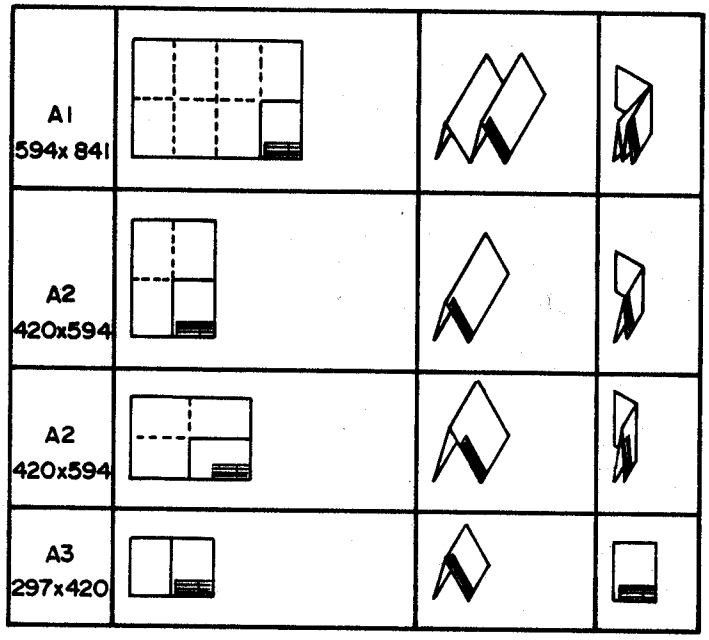


Figure 2

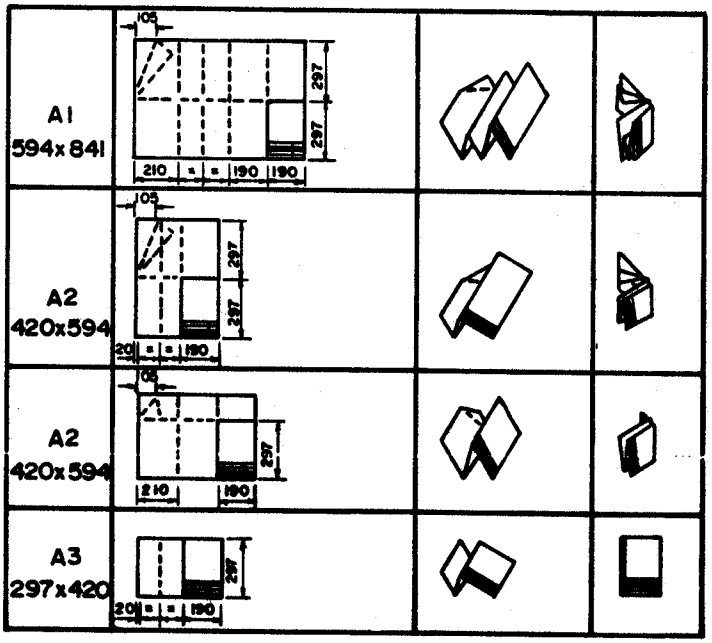


Figure 3

Drawing Sheet Material

The material used for the preprinted drawing sheets is .003 polyester drafting film, matte both sides. The reason for matte both sides is to allow for drawing on either side of the original. In some cases it may be expedient to produce second generation originals to eliminate time consuming redrafting. In these cases the intermediate must be .003 blackline polyester drafting film with a clear dense reproduction of the image without background.

Drawing Medium

It is preferred that contract drawings be prepared using ink and mechanical lettering to ensure consistency of quality and appearance. However, the same plans may be prepared using pencil and freehand lettering, if sufficient care is exercised to maintain the minimum line weights and lettering sizes. The use of pencil and ink on the same drawing shall be avoided because of the difficulty in producing acceptable microfilm from drawings with a large range in line densities.

Lettering

General

Lettering shall be used on drawings to convey information that is not readily or clearly indicated by graphics alone, and the combination of lettering and graphics should fully and concisely define the object being drawn. The essential features of lettering on technical drawings shall be:

- legibility
- uniformity
- suitability for microfilming and other photographic reproduction

Lettering Sizes

The recommended lettering sizes follow a system devised by the International Standards Organization.

The heights for normal use are: 1.8, 2.5, 3.5, 5.0, and 7 mm but larger characters may be required for special artwork and titling. These character heights bear the same 1: 2 relationship to one another as do drawing sheet sizes.

The stroke width for each size of lettering is 1/10 of the height. For example, for a letter height of 5.0 mm a 0.50 mm pen would be used; the minimum height of lettering to be used on the A1 size drawing sheet is 2.5 mm.

Templates and pen sizes in accordance with the above recommendations are commercially available. Freehand lettering should conform as closely as possible, with particular care required for letters B, C, D, G, O, Q, as well as numerals 3, 5, 6, 8, and 9 to ensure legibility when reduced in size.

Type (Style) of Lettering

All lettering shall be single stroke, commercial gothic (Figure 4). Vertical upper case lettering is preferred since upper case letters reproduce better at one-half size. Slant lettering may be used to achieve a visual difference between different types of information i.e. new construction and existing conditions. When slant lettering is used, it should be inclined 15° to the right. An exception to the standard relates to metric symbols, which require vertical lower case.

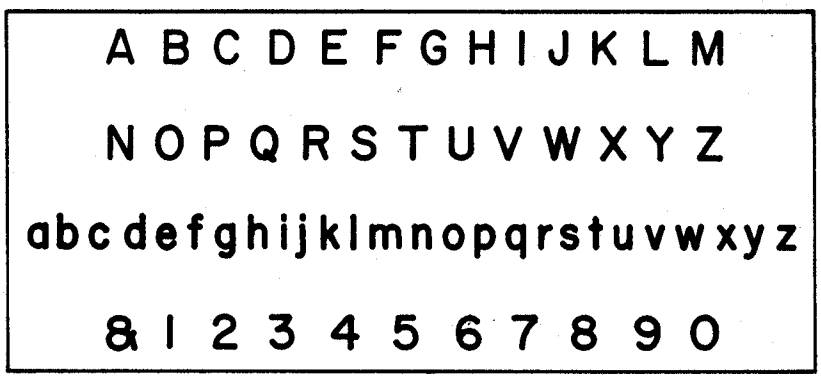


Figure 4

Spacing

The recommended clear space between letters and figures should be approximately equal to twice the stroke width of the line used. The space between words should be equal to that required by the letter O if touching both words, and the space between sentences should be double that between words.

Lettering shall only be underlined when special emphasis is required, such as in headings and section symbols. The underlining shall not be less than 2.0 mm below the lettering.

Mechanical Lettering

Drawings prepared with mechanical lettering instruments permit a number of technical staff members to work on similar drawings of the project and maintain standards of lettering.

For an A1 size drawing, a pen size of .25 using a 100 slide for general notation and a .7 pen with a 175 slide for titles and headings is an acceptable standard.

Typewritten Lettering

The use of typewriters to produce lettering on drawings is desirable when good typing equipment and proper ribbons are used as they provide good quality letters for microfilming purposes. Typing should be used in the preparation of drawings wherever practical and economical. Typing can be done directly on the drafting film or on an adhesive backed, pressure sensitive, translucent matte film which is receptive to typing, and can be burnished directly on the drafting film. The printwheel or ball of the typewriter shall be either gothic or orator.

Total transfer ribbons of polyester film or acetate are recommended.

Drying of typed data can be accelerated by spraying with drying products. Spraying with a clear lacquer such as "Krylon" Permanent Crystal Clear Spray Coating, or Blair Spray Fix #100 will protect the typing from smudging or accidental removal. Typing can be removed cleanly and completely with plastic or soft rubber erasers, if it is done prior to spraying with a lacquer.

Stamped Notation

Impressions made with rubber or plastic stamps shall be placed on the front of drawing sheets. The stamp shall be cleaned before each inking and the type of ink used shall be of the non-gaseous variety to reduce the possibility of chemical damage to adjacent drawings in files.

When making the impression, extra care shall be taken to ensure that a sharp, clear opaque image is produced.

Orientation of Lettering

The direction of lettering shall conform with the slope of the symbol or line. The correct placement is as shown in Figure 5. Examples of correct and incorrect practices for orientation of lettering are shown in Figure 6. The space between line and lettering shall not be less than 1 mm.

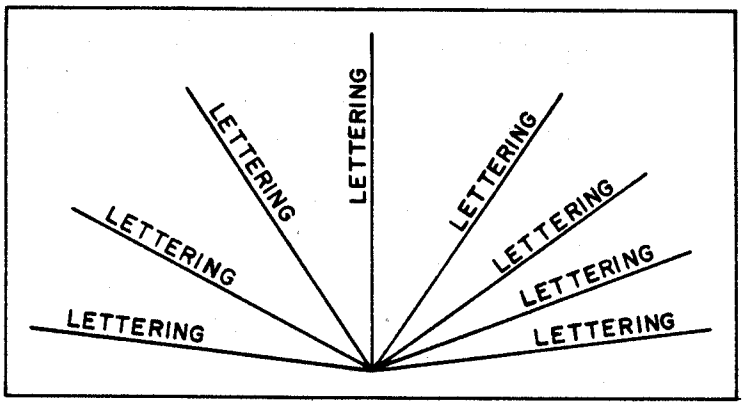


Figure 5

EXAMPLE

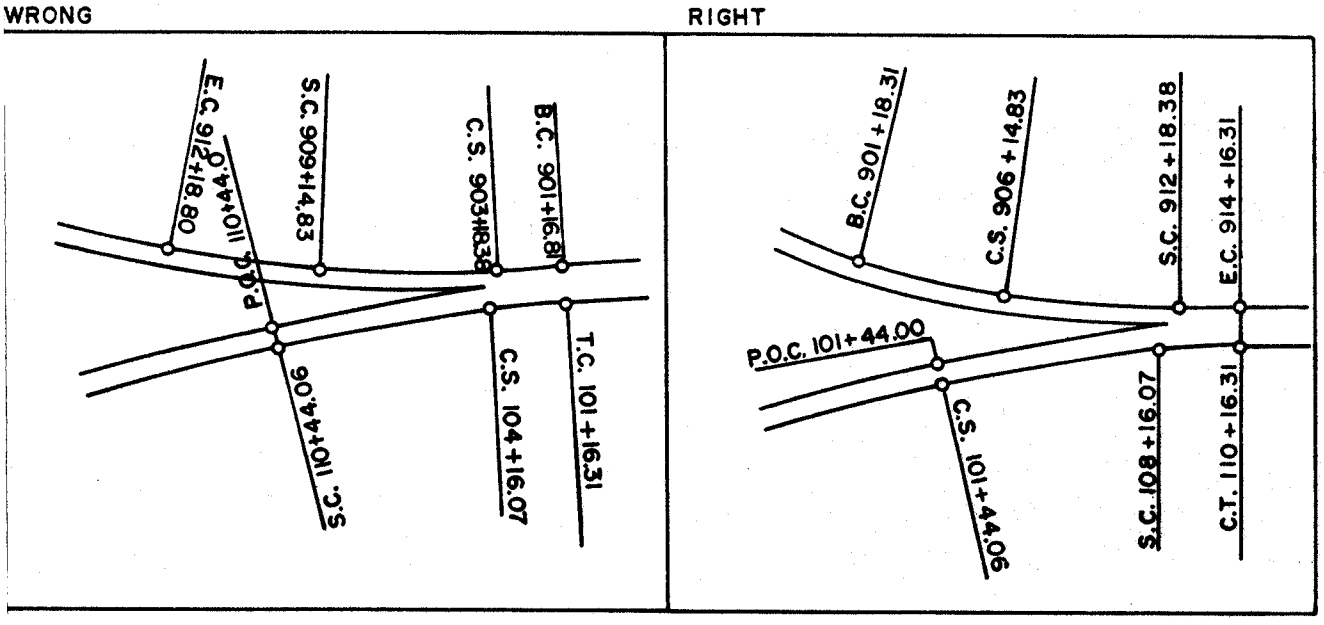


Figure 6

Lines

Engineering drawings produced for or by the City of Winnipeg, Works and Operations Division are now being microfilmed, the film mounted in aperture cards, and filed for day-to-day retrieval and reference. These can be subsequently reproduced on one-half of the original full size prints, depending on the size of the original drawing. Frequently, drawings are reduced to half size for tendering purposes (for ease of use in the field), which necessitates important drafting considerations relating to line width, lettering, line density, spacing, etc. outlined below.

Range of Thickness

As with lettering, the range of line thicknesses shall be a geometric progression based on a ratio of $1: \sqrt{2}$. Commencing with the minimum thickness of 0.18 mm, the thickness shall be as follows:

0.18 mm 0.25 mm 0.35 mm 0.50 mm 0.70 mm 1.0 mm

Spacing Between Lines

The minimum spacing between lines of any type is 1 mm. The reason for this is to assure readability and reproducibility at reduced sizes. When representing edges of thin materials such as sheet metal, these should be shown by means of one thick line rather than two closely spaced thinner lines.

Figure 7 is a magnification of Pencil, Plastic Lead, and Ink lines drawn on different mediums to illustrate the quality of line achieved.

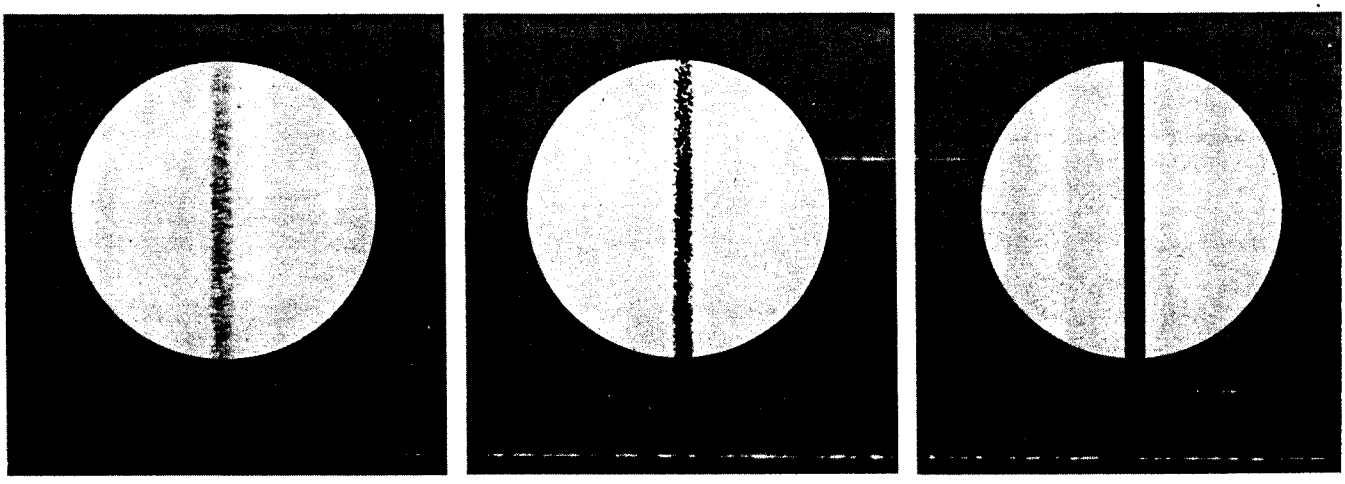


Figure 7

Line Quality

All lines shall be dense, black, bold and be of consistent density and reflectance. Lines of differing thicknesses shall be used to facilitate the reading of a drawing; however, the range and thickness shall be kept to a minimum and should be used consistently for the same type of drawing.

The following table is used to assure microfilm images of reproducible quality. It allows for determining the line widths to be used on Works and Operations Division drawings which are to be reduced on commonly-used microfilm formats. Microfilm images with line widths less than 12 microns at 14.5X or 8 microns at 24X are of insufficient quality to assure satisfactory reproduction.

Metric Drawing Sizes	Reduction Ratio (35 mm Film)	Expected Image Line Width in Microns					
Pen Sizes		.18	.25	.35	.50	.70	1.00
A4 A3 A2	14.5 X	12	17	25	35	50	71
A1	29 X	6	8	11	16	23	33

▨ Insufficient Quality

Table 3

** one micron = 0.0000394 inch

North Arrow

The north arrows shown below is for general use and is produced as a stick-on in the following 4 sizes in standard and reverse images.

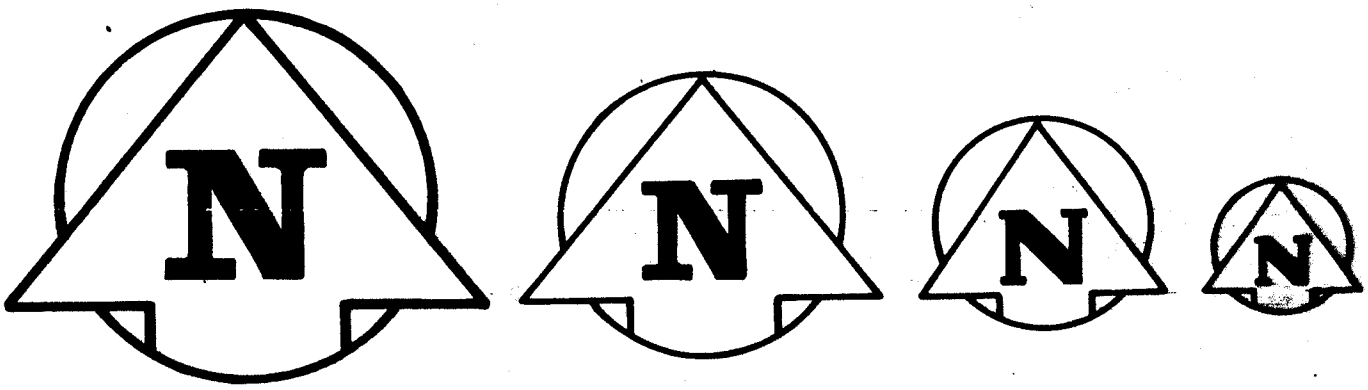


Figure 8

Drawing Orientation

The plan shall be oriented to allow pointing of the north arrow to the top or to the right of the sheet for the major portion of the alignment. Assuming the top of the sheet as due north, the range within which the north arrow may point is from 45° westerly of north to 135° easterly of north (see Figure 9).

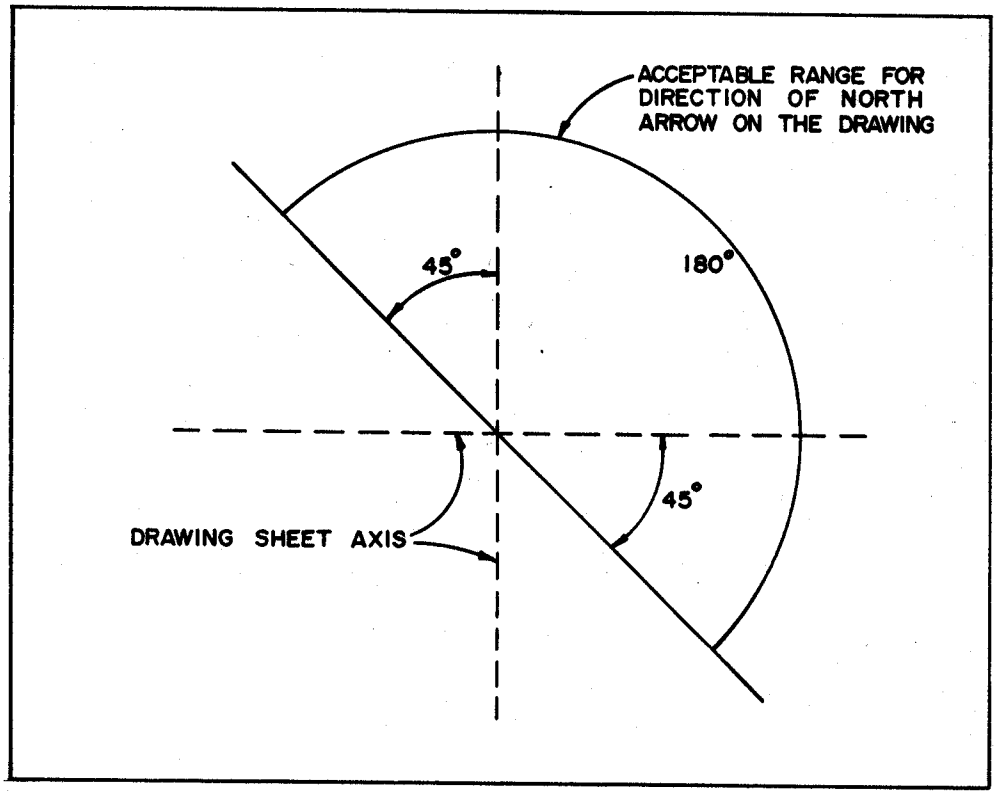


Figure 9

Contract Drawing Sets

The number of drawings and division of detail within a set of drawings will vary greatly depending upon the magnitude and intricacy of the project. The division of information within a set of drawings should follow the general categories described in Part 4.

Drawing Index Sheet

A drawing index shall be used and follow immediately after the cover sheet when the set of drawings is comprised of fifteen (15) sheets or more.

PART 2

TECHNICAL LEGENDS

AND

ABBREVIATIONS

Legends

The technical legend illustrated in this section was developed to provide a source of symbols for use on all types of construction drawings prepared by or for the Works and Operations Division. General purpose legends have been preprinted on drawing sheets used by the District Operations Offices, but are not printed on drawing sheets used by the Streets and Transportation Department and the Waterworks and Waste Disposal Department. In the case of the latter Department, general legends are available as stick-ons and are only applied if required.

The various legend items have been illustrated in six general categories as follows:

Waste Water Collection
Water Distribution
Land Drainage
Road Construction
Existing Underground Utilities
Miscellaneous

In each category, with the exception of Existing Underground Utilities, a legend has been provided to represent an item which exists in the field as well as one which is proposed. Plan and profile legends have been provided for Water Distribution, Drainage and Road Construction Categories; the other categories have plan legend only.

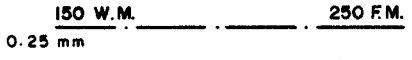
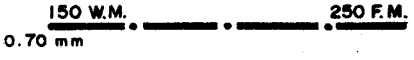
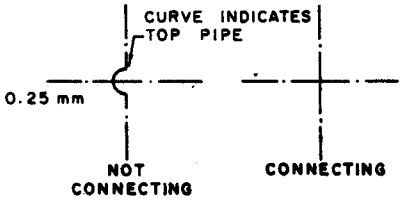
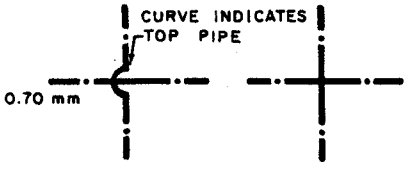
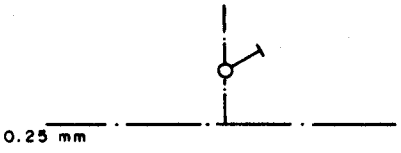
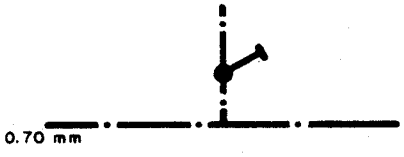
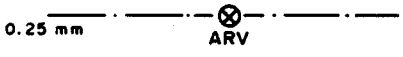
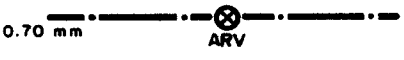
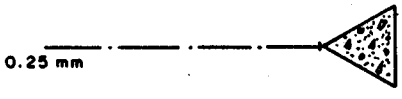
Although the legend is essentially self-explanatory, the following notes are included to clarify areas where it seemed necessary.

Figures such as 0.25 mm or 0.70 mm adjacent to line symbols are suggested line thicknesses conforming to recommendations made with respect to drawing format.

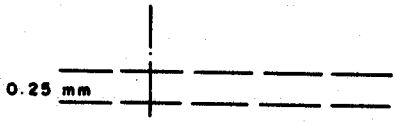
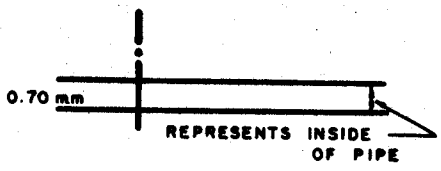
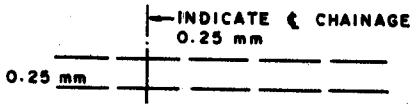
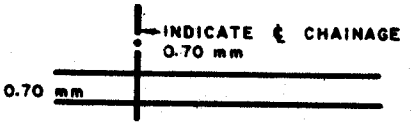
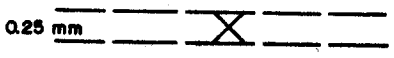
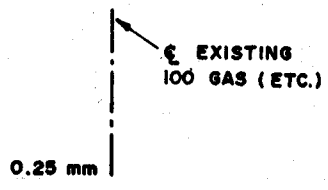
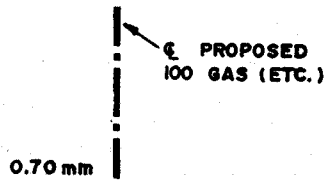
The legend for crossing utilities in the Water Distribution-Profile and Drainage-Profile sections is intended to indicate utilities which are running transverse to the proposed watermains or sewer. The vertical centre line is used to avoid indicating a precise elevation of the utility which may or may not be correct.

Under the "Existing Facility" column in the road construction-profile legend you will notice a series of lines each having a different symbol to illustrate the actual location of a surveyed elevation. The idea behind having a symbol for the actual elevation as well as a symbol line to join the points is to allow flexibility in illustrating existing information. For instance, it would be possible to illustrate only the points and not the lines between the points in cases where it was felt that these lines would clutter the drawing and make it difficult to read. If it is needed for assessing the design or for field comparisons the existing information is always there. Points can be joined freehand if necessary to visualize a line of levels.

TECHNICAL LEGEND
WATER DISTRIBUTION – PLAN

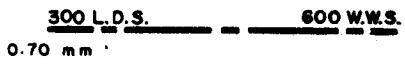
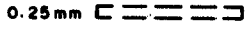
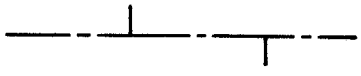
ITEM	EXISTING FACILITY	PROPOSED FACILITY
WATERMAIN (W. M.) OR FEEDERMAIN (F. M.)		
CROSSING PIPES		
FIRE HYDRANT		
WATER VALVE		
MANHOLE		
SERVICE VALVE		
AIR RELIEF VALVE		
THRUST BLOCK		

TECHNICAL LEGEND
WATER DISTRIBUTION – PROFILE

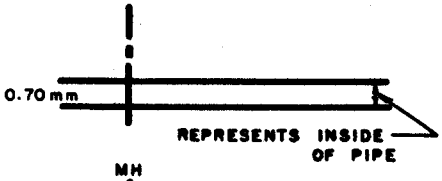
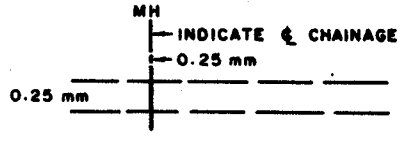
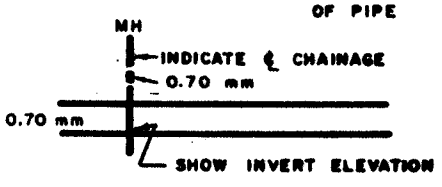
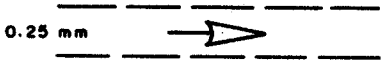
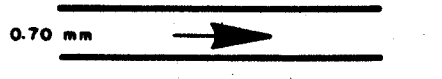
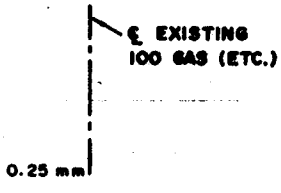
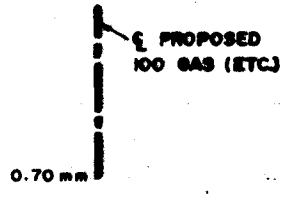
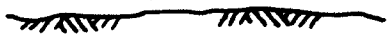
ITEM	EXISTING FACILITY	PROPOSED FACILITY
WATERMAIN (W. M.) OR FEEDERMAIN (F. M.)		
MANHOLE		
VALVE		
CROSSING UTILITIES —— INDICATE ALIGNMENT BY ℄ ONLY. DO NOT ATTEMPT TO INDICATE DEPTH ON PROFILE.		
GROUND LINE (DIRECTLY ABOVE ℄ OF PIPE.)		

TECHNICAL LEGEND

DRAINAGE - PLAN

ITEM	EXISTING FACILITY	PROPOSED FACILITY
LAND DRAINAGE SEWER (L.D.S.) WASTE WATER SEWER (W. W. S.)		
MANHOLE		
CATCH BASIN		
CATCH BASIN INLET		
CULVERT		
WASTE WATER SEWER JUNCTIONS		

DRAINAGE - PROFILE

LAND DRAINAGE SEWER WASTE WATER SEWER		
MANHOLE		
FLOW ARROWS		
CROSSING UTILITIES —— INDICATE ALIGNMENT BY ℄ LINE ONLY. DO NOT ATTEMPT TO INDICATE DEPTH ON PROFILE.		
GROUND LINE (DIRECTLY ABOVE ℄ OF PIPE)		

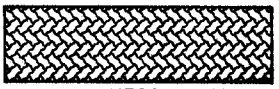
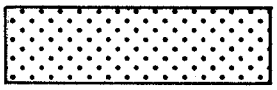
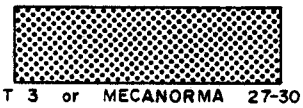
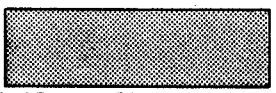
TECHNICAL LEGEND

ROAD CONSTRUCTION - PLAN

ITEM	EXISTING FACILITY	PROPOSED FACILITY
EDGE OF PAVEMENT (NO CURB)	0.25 mm	0.70 mm
EDGE OF PAVEMENT (CURBED, CURB & GUTTER) *(BACK OF CURB)*	0.25 mm	0.70 mm
SIDEWALK	0.25 mm	0.50 mm or 0.70 mm
ELEVATIONS	40.265	40.265
ALIGNMENT CONTROL		
SIDEWALK RAMP		
DITCH	0.25 mm	0.70 mm

TECHNICAL LEGEND

ROAD CONSTRUCTION - PLAN

ITEM	EXISTING FACILITY	PROPOSED FACILITY
CONCRETE INTERLOCKING BLOCKS		 LT 338 or MECANORMA 1262 FOR 1:200 & 1:250 SCALES DRAWINGS  MECANORMA 1263 FOR 1:500 SCALE DRAWINGS
CONCRETE PAVEMENT (ROADWAYS)		 LT 915 or MECANORMA 208
CONCRETE WALKS & MEDIANS		 LT 3 or MECANORMA 27-30%
ASPHALT PAVEMENT OR ASPHALT OVERLAYS		 LT 37 or MECANORMA 55-20%
UNSPECIFIED MISCELLANEOUS CROSSHATCHING		 LT 926 or MECANORMA 499
SHOULDERS (GRAVEL OR ASPHALT)		 LT 134 MECANORMA 669
SHADING (IF REQUIRED)		 LT PANTONE 319A

NOTE: Shading symbols on this page must be used to differentiate between various types of construction shown in close proximity on the drawings. When only one type of work is proposed, shading can be omitted at the discretion of the designer.

TECHNICAL LEGEND
ROAD CONSTRUCTION PROFILE

ITEM	EXISTING FACILITY	PROPOSED FACILITY
PAVEMENT	0.25 mm — NORTH & WEST GUTTER; SOUTH & EAST GUTTER; CENTRE LINE	0.70 mm — NORTH & WEST GUTTER; SOUTH & EAST GUTTER; CENTRE LINE
PRAIRIE OR PROPERTY LINE	0.25 mm — NORTH & WEST; SOUTH & EAST	
DITCH	0.25 mm — NORTH & WEST; SOUTH & EAST	0.50mm or 0.70mm — NORTH & WEST; SOUTH & EAST
SIDEWALK	0.25 mm — NORTH & WEST; SOUTH & EAST	0.50mm or 0.70mm — NORTH & WEST; SOUTH & EAST
GARAGE FLOOR OR DRIVEWAY	C — CONCRETE (C); WOOD (W); GRAVEL (G); MUD (M)	
PRIVATE WALK OR DOOR SILL		

NOTE: Elevation symbols ⊡ △ ▽ are optional for pavement, ditch and sidewalk.

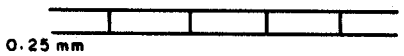
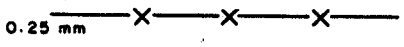
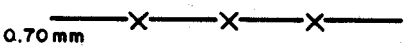
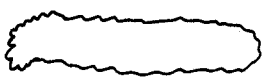
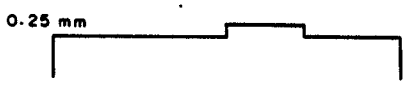
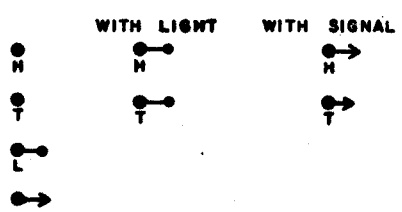
TECHNICAL LEGEND

EXISTING UNDERGROUND STRUCTURES

UTILITY	SYMBOL
WINNIPEG HYDRO STREET LIGHTING (S.L.) MANITOBA HYDRO	
MANITOBA TELEPHONE SYSTEM (M.T.S.)	
TRAFFIC SIGNALS (T.S.)	
LAND DRAINAGE SEWER (L.D.S.) STORM RELIEF SEWER (S.R.S.) WASTE WATER SEWER (W.W.S.)	
WATERMAINS (W.M.)	
GAS	
C.P.R. TELEGRAPHS C.N.R. TELEGRAPHS	
WINNIPEG HYDRO STEAM HEAT WINNIPEG CENTRAL HTG. CO. STEAM HEAT (S.H.)	

NOTE : ALL LINE THICKNESSES ARE 0.25 mm

TECHNICAL LEGEND
MISCELLANEOUS

ITEM	EXISTING FACILITY	PROPOSED FACILITY
PROPERTY LINE		
SURVEY BAR		
GEODETIC BENCH MARK GEODETIC SURVEY MONUMENT GEODETIC CONTROL MONUMENT		
RAILWAY TRACKS		
FENCE		
MANHOLE — SPECIFY TYPE : MTS - T SEWER - S HYDRO - H		
TREE		
TREE AREA OR BUSH		
BUILDINGS		
SIGNAL CONTROLLER (RAILWAY OR TRAFFIC)		
SLOPE — CUT OR FILL		
HYDRO TOWER		
GUY ANCHOR		
POLES HYDRO POLE M. T. S. POLE LIGHT STANDARD TRAFFIC SIGNAL POLE		

STANDARD ABBREVIATIONS

ABBREVIATIONS - GENERAL

A

Abandon (ed)	ABAN
Abutment	ABT
Acre	A
Air Relief Valve	ARV
Allowance	ALW
Altitude	ALT
Angle	ANG
Annual Average Daily Traffic	AADT
Approximate	APROX
Asbestos Cement	AC
Asphalt	AS
Asphalt Curb	ASC
Asphalt Sidewalk	ASW
Avenue	AVE
Average	AVG
Azimuth	AZ

B

Back Sight	BS
Base Line	℄
Base of Rail	BOR
Bearing	BG
Bedrock	BR
Beginning of Curve	BC
Beginning of Vertical Curve	BVC
Bench Mark	BM
Between	BET
Block	BLK
Board Fence	BF
Bottom of Bank	BB
Bottom of Ditch	BD
Boulevard	BLVD
Boundary	BNDY
Brick	BK
Bridge	BRG
Building	BLDG
Burlington Northern Railway	BNR

C

Canadian National Railway	CNR
Canadian Pacific Railway	CPR
Cast Iron	CI
Catch Basin	CB
Centreline	℄
Chain Link Fence	CLF
Checked	CHKD
Chord	CH
Circular	CIR
Circular Curve to Spiral	CCS
Clay	CL
Combined Sewer	CS
Concrete	CONC
Concrete Curb	CC
Curb & Gutter	C&G
Concrete Pipe	CP
Concrete Interlocking Blocks	CIB
Concrete Sidewalk	CSW
Concrete Wall	CW
Connection, Connecting	CONN
Construction	CONST
Control Point	CPT
Coordinate	COORD

C	
Correction	CORR
Corrugated Metal Pipe	CMP
Corporation	CORP
Creek	CR
Creosoted Timber Culvert	CTCLV
Crescent	CRES
Cross Section	XSEC
Culvert	CLV
D	
Deflection	DEF
Degree	DEG
Department	DEPT
Departure	DEP
Design Speed, km/h	V
Detour	DET
Diameter	DIA
Difference	DIFF
Distance	DIST
Ditch	D
Ditch Inlet	DI
Division, Diversion	DIV
Drainage	DG
Drawing	DWG
Drive	DR
Ductile Iron	DUC
E	
East	E
Eastbound	EB
Edge of Pavement	EPAVT
Edge of Shoulder	ESH
Effluent	EFF
Elevation	ELEV
End of Curve	EC
End of Vertical Curve	EVC
Entrance	ENT
Excavation	EXC
Expressway	EXWY
Extension	EXTN
F	
Feedermain	FM
Fence	F
Fibreglass Reinforced Cement	FRC
Flashing Light	FL
Flashing Light & Bell	FLB
Foot, Feet	FT
Forcemain	FRM
Foresight	FS
Found	FD
Foundation	FDN
G	
Gallon	GAL
Gas Valve	GVLV
Gate Valve	GV
Gate & Flashing Light	GTFL
Gate, Flashing Light & Bell	GTFLB
Geodetic Bench Mark	
Geodetic Control Monument	MON
Geodetic Survey Monument	

G	
Grade Point	GP
Grading	GD
Granular	GRAN
Granular Backfill	GBFL
Granular Base	GB
Granular Base Course	GBC
Gravel	GRL
Guard Rail	GR
H	
Headwall	HW
Hectare	HA
Height	HT
Height of Instrument	HI
High Tension Line	HTL
High Water Level	HWL
Highway	HWY
Horizontal	HORZ
Hot Mix	HM
Hub of Curve	HOC
Hub on Spiral	HOS
Hub on Sub-Tangent	HOST
Hub on Tangent	HOT
Hydrant	HYD
Hydro	H
Hydro Cable	HC
Hydro Guy Pole	HGP
Hydro Pole	HP
I	
Ice Level	IL
Inside Diameter	ID
Instrument	INST
Intermediate Sight	IS
Invert Elevation	INV EL
Iron Bar	IB
J	
Junction	JCT
K	
Kilovolt	KV
Kilowatt	KW
L	
Land Drainage Sewer	LDS
Latitude	LAT
Length	L
Length of Vertical Curve	LVC
Light	LT
Light Standard	LS
Longitude	LONG
Low Water Level	LWL
M	
Manhole	MH
Maximum	MAX
Mean Water Level	MWL
Mean Summer Water Level	MSWL
Median	MED
Minimum	MNM
Minute	MIN
Monument	MON
N	
Normal Water Level	NWL
North	N
Northbound	NB
Number	NO
O	
Original	ORIG
Original Ground	OG
Outside Diamenter	OD
Overhead Sign	OHS

P

Pavement	PAVT
Plan	PL
Planted	PTD
Point of Compound Curve	PCC
Point of Intersection	PI
Point of Intersection of Tangent Grades	PITG
Point of Intersection of Vertical Curve	PIVC
Point of Vertical Intersection	PVI
Point on Curve	POC
Point of Compound Curve	PCC
Point on Reverse Curve	PRC
Point on Spiral	POS
Point on Vertical Curve	PVC
Poly Vinyl Chloride	PVCL
Prestressed Concrete	PC
Property Line	P
Proposed	PROP
Provincial Trunk Highway	PTH

R

Radius	R
Range	RGE
Rail	RL
Railway	RLWY
Reference Point	RP
Reinforced Concrete	RC
Resurfacing	RESURF
Retaining Wall	RW
Revised, Revision	REV
Right-of-Way	ROW
Road	RD
Rounding	RND

S

Second (s)	SEC
Service Road	SERV RD
Sidewalk	SW
Signal Controller	SC
South	S
Southbound	SB
Specification	SPEC
Spiral	SP
Spiral to Circular Curve	SCC
Spiral to Tangent	STAN
Square	SQ
Superelevation	SELEV
Standard	STD
Station	STA
Storm Relief Sewer	SRS
Steel Beam Guard Rail	SBGR
Storey	STY
Street	ST
Structure	STR

T

Tangent	TAN
Tangent to Spiral	TANS
Telephone Booth	TB
Telephone Pole	TPL
Timber Culvert	TCULV
Top of Bank	TOB
Top of Rail	TOR
Township	TWP
Traffic Signal	TS
Trans Canada Highway	TCH
Transformer	TRNSF
Transverse	TRNSV
Traverse	TRVS
Turning Point	TP

V

Valve	VLV
Velocity	VEL

V

Vent Valve	VV
Vertical	VERT
Vertical Curve	VC
Volume	VOL

W

Waste Water Sewer	WWS
Water Level	WL
Watermain	WM
Water Valve	WV
West	W
Westbound	WB
Wing Wall	WW
Work Order	WO

ABBREVIATIONS - CURVE DATA

Δ	Delta-Angle subtended by simple curve
Δ_s	Central angle of spiral arc "spiral angle"
Δ_c	central angle of circular are between SC and CS
o	Degree(s)
D	Degree of Curve
E	External Distance - circular curve
E_s	External Distance - spiralled curve
L	Length of Simple Circular Curve
LC	Long Chord of Spiral Curve
LT	Long Tangent of Spiral Curve
'	Minutes
R	Radius of Circular Curve
"	Seconds
ST	Short Tangent of Spiral Curve
T	Sub Tangent Length of Circular Curve
T_s	Total Tangent Distance - Spiral Curve - PI to TS or PI to ST

PART 3

METRIC DRAWING PRACTICES

The purpose of this section is to set down general metric drawing practices as they apply to the municipal engineering field. A description of the most common S.I. units that the technician will encounter in his day-to-day work has been included. Definitions and symbols of the complete system are given in the National Standard CAN-3-001-01-73, the International System of Units (SI).

1. SI UNITS RECOMMENDED FOR GENERAL USE

Units of Length

Linear dimensions are expressed in multiples and submultiples of the metre. Metric linear units include:

	Metres	
micrometre	0.000 001	= 10-6
millimetre	0.001	= 10-3
centimetre	0.01	= 10-2
decimetre	0.1	= 10-1
metre	1	
decametre	10	= 101
hectometre	100	= 102
kilometre	1 000	= 103

Of these, only three will be used frequently in the municipal engineering field:

millimetre - mechancial and architectural details

metre - location plans for watermains, sewers, pavements, etc.

kilometre - geographical and statistical purposes

The relationship between these units is:

1000 mm = 1 m
1000 m = 1 km

Units of Volume

Precise volumes, actual physical volumes, and the volume of solids should be expressed in cubic metres - m3 (excavation, fill, base course, etc.).

The litre (L), a non-SI unit, may be used for liquids and for some commercial measurements:

1000 L = 1 m3

Units of Angles

Angles are supplementary SI units. The units indicated in the Canadian Metric Practice Guide are: the radian (rad) for plane angles and the steradian (sr) for solid angles. However, for municipal engineering purposes, it is recommended that the use of degrees (o), minutes ('), and seconds (") be continued.

Units of Temperature

Temperature in the modern metric system will be expressed in degrees Celsius (^{o}C). (Non-SI unit)

The symbol ^{o}C is read as degree Celsius (not centigrade).

On the Celsius thermometer scale the freezing point of water is $0^{o}C$.

The boiling point of water is $100^{o}C$.

Note: The official units of thermodynamic temperature in SI is the kelvin (K), but this is used almost exlusively in scientific work.

Units of Pressure

Pressure in liquids and gases is expressed in pascals (Pa), kilopascals (kPa), or megapascals (MPa).

Some equipment may be graduated in mm of mercury. Air pressure, although variable, may be taken as 101.3 kPa, which is approximately equivalent to 760 mm of mercury.

Note: The pascal is the pressure (or stress) which is produced when a force of one newton is applied to an area of one square metre.

Units of Mass

The units of mass which will be generally encountered are the gram (g), the kilogram (kg), and the tonne (t).

The relationship between these units is

1 kg = 1000 g
1 t = 1000 kg

Metric Scale Ratios

The Canadian Government Specifications Board (CGSB) standard 88-GP-20M sets out scales and ratios recommended for use in charts, maps, and plans in the metric system. The standard includes a comprehensive list ranging from 1:1 000 000 reduction to 100:1 enlargement based on the 1, 2, 5 series for use in architecture, engineering, construction, surveying, and mapping. For convenience, the recommended metric scales for general use in the municipal engineering field and the closest equivalent imperial scale are listed in Table 4.

One departure from the Canadian standard, which is included in Table 4, is the scale 1:250, which is included to allow wide rights-of-way to be drawn on the plan-profile formats when necessary.

Metric Ratio Scale	Replaces
1 : 2000	1 " = 200'
1 : 1000	1 " = 100'
1 : 500	1 " = 40'
1 : 250	1 " = 20'
1 : 200	1/16" = 1'
1 : 100	1/ 8" = 1'
1 : 50	1 " = 4'
1 : 20	1 " = 2'
1 : 10	1 " = 1'

Table 4

2. THE USE OF RATIO SCALES FOR EXISTING IMPERIAL PLANS

The following is an extract from material prepared by the Ontario Ministry of Transportation and Communications.

1 inch = 20 feet
1 inch = 40 feet
1 inch = 100 feet
1 inch = 200 feet

The before-mentioned scales are not considered ratios because they deal in different units, namely inches and feet. To convert them to ratios they must be thought of as 1:240, 1:480, 1:1 200, and 1:2 400, with the result that

1 inch = 240 inches
1 inch = 480 inches
1 inch = 1 200 inches
1 inch = 2 400 inches respectively.

By taking the engineer's scale and applying it to a limit on the plan the reader can count off the number of inches portrayed on the ground; for example, at a ratio of 1:1 200, the result is: 1" = 100', See Figure 10.

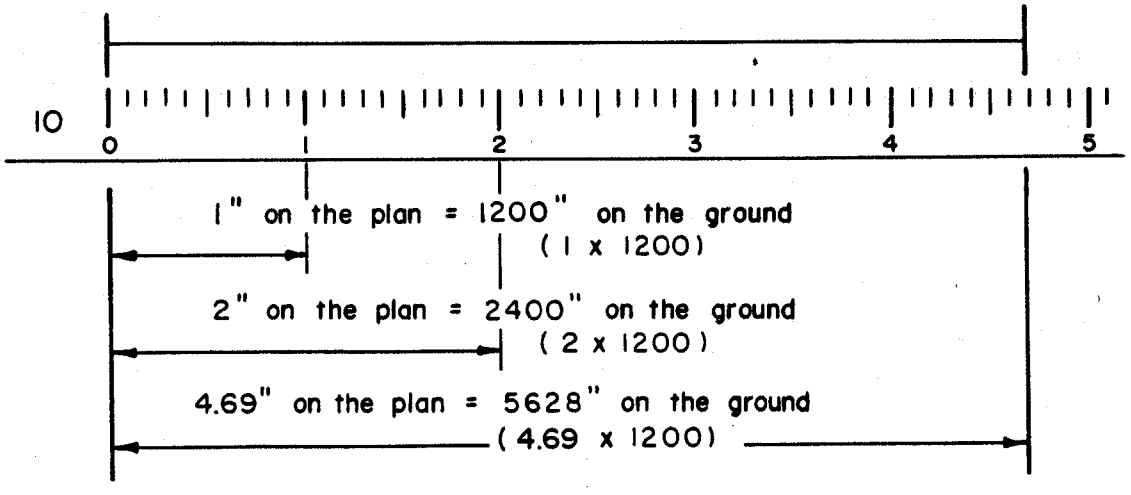


Figure 10

Because the base relationship of inches to feet is 1:12, it is difficult to use the engineer's scale as a ratio scale. Therefore in the past it has been easier to relate 4.69" on the plan to 469' on the ground rather than 5628" on the ground.

However, the metric system is on a base 10 where:

10 mm = 1 cm
10 cm = 1 dm
10 dm = 1 m

For survey purposes in the metric system we will no longer be using 1" = 20' (1" = 240"), 1" = 40' (1" = 480") or 1" = 100' (1" = 1200"), but will be preparing the drawings in ratios of 1:200, 1:500 and 1:1 000 respectively, and multiples of 10 where applicable for smaller scale drawings.

This means that 1 cm on the plan = 500 cm on the ground or more conventionally, 1 cm on the plan = 5 m on the ground.

A drawing at a ratio of 1:500 is 4% smaller than our present drawing at a scale of 1" = 40'.

Because of the different sizes of detail on the old and new drawings the reader in the future will have to be familiar with the use of the engineer's scale for old drawings, be capable of using an imperial ratio scale and a metric ratio scale for new drawings and also be able to convert from metric units to imperial units and vice versa to relate information from plans in the two different formats.

Presently survey plans being prepared under the imperial system of measurements are dependent upon the plan size, and may vary such as

1" = 20'
1" = 100'

Construction plans in the future will be compiled under the metric system of ratios, e.g., 1:500, 1:1 000, 1:2 000, 1:5 000. The metric scale will be interpreted in terms of metres. For example,

1:100 indicates 1 unit = 100 units; therefore,
1 cm (on scale) = 100 cm (on ground) = 1 m (on ground)

The following guide will indicate proper metric ratio interpretation:

	PLAN		FIELD
1:20	1 m	=	20 m
1:200	1 m	=	200 m
1:2 000	1 m	=	2 000 m
1:20 000	1 m	=	20 000 m

	PLAN		FIELD
1:50	1 m	=	50 m
1:500	1 m	=	500 m
1:5 000	1 m	=	5 000 m
1:50 000	1 m	=	50 000 m

	PLAN		FIELD
1:100	1 m	=	100 m
1:1 000	1 m	=	1 000 m
1:10 000	1 m	=	10 000 m
1:100 000	1 m	=	100 000 m

3. HORIZONTAL CURVATURE

It has been the practice of some City offices to express horizontal curvature in degrees. This practice is to be discontinued and the radius definition adopted. Radius will be expressed in metres.

Metric curve tables for circular and spiral functions are available from the Roads and Transportation Association of Canada (RTAC).

Stationing Intervals

The station interval for road measurement shall be 100 m (1+00.00). Despite the fact that it is 3.28 times as long as the current station, it can readily be broken down into suitable sub-units and is compatible with the practice of referring to grades in terms of percentages.

Cross-Section Intervals

The recommended cross-section intervals for design and quantity calculation purposes are 10, 20, and 50 m.

Contour Intervals

Following the RTAC recommendation, the contour intervals for use with metric plans and ratio scales should be 0.5 m, 1 m, 2 m, 5 m, 10 m, and multiples of same by appropriate powers of 10 as suited to the chosen ratio scale and application of plan. It is recognized that in our area the range of contour intervals would be limited to 0.5 m, 1 m, and 5 m.

Dimensioning

On utility or roadway location plans and on miscellaneous site plans, all distances should be shown in metres and decimals thereof. For any mechanical, architectural, electrial details, dimensions should be shown in millimetres.

It will not be necessary to place the appropriate metric symbol (m or mm) after each dimension if the following note is placed boldly on the drawing:

METRIC

WHOLE NUMBERS INDICATE MILLIMETRES
DECIMALIZED NUMBERS INDICATE METRES

Whenever a dimension is used in a statement on a drawing, it is suggested that the appropriate metric symbol be included. For example, a statement such as:

"From a point 300 east of Broadway . . ."

should be written

"From a point 300 m east of Broadway . . ."

PART 4

SPECIAL REQUIREMENTS FOR THE PRODUCTION OF DRAWINGS

General Drawing Requirements

A construction drawing may contain information for the installation of more than one service; however, superimposure of a new utility on an old drawing which already carries approvals from former installations is not permitted.

Consulting firms preparing contract drawings for the Works and Operations Division are asked to provide adequate existing site information on the drawing to permit independent assessment of the design by the initiating City agency.

Chainages on drawings should proceed from left to right and from bottom to top corresponding to west to east and south to north. When more than one plan is required, the most westerly sheet should be first, and subsequent sheets continue in an easterly direction. Similarly, sheet progression should be from south to north.

Requirements for "As Constructed" Drawings

Finally, it must be kept in mind from the outset, that the construction drawing will become a valuable permanent City record. It is extremely important that the designing agency maintain an accurate record of any changes to the design occurring in the field, and that these changes are accurately and completely recorded on the construction drawing.

When a project is completed, the originals of the contract drawings must be revised and forwarded to the initiating City office. Copies of any manufacturer's drawings for equipment which was installed as part of the contract are also to be forwarded. These drawings then become part of the permanent City records.

In order that drawings which originate with the various consulting firms maintain uniformity in the presentation of "as constructed" information and that the drawings are forwarded within a reasonable period of time, the following procedures are to be followed:

- all geometric details to be corrected to final measurement
- all "as constructed" drawings must be supplied in their original form on .003 mylar (not on an intermediate reproduced from the original)
- all alignment details should be retained on the "as constructed" drawings to facilitate possible redrafting
- all "as constructed" drawings are to be clearly identified as such with a date and signature.
- "as constructed" drawings must be completed and delivered to the requesting agency <u>within three months</u> of the completion of the project.

Requirements For Roadway Construction Drawings

Roadway construction drawings should be clear and precise. The amount of information required varies greatly with the complexity of the project. In general, information required on roadway construction drawings must fulfil the following requirements:

Right-of-Way

Roadway construction drawings must identify and fully describe the right-of-way limits for the project on the plan view as follows:

- basic information including street right-of-way widths, block dimensions, street angles at intersections, right-of-way deflection angles, survey bars, curve data for the right-of-way (including length of curve, deflection angle, sub tangent and radius) and corner cuts.

- if the construction project has utilized a coordinate system, the limits of the right-of-way and all legal survey bars and geodetic survey control monuments must be tied into that system.

Horizontal Alignment

"Horizontal Alignment" is information which could in any way be used to describe the pavement alignment. The required information is as follows:

- centreline or baseline chainage must be tied to all intersecting street rights-of-way, legal survey bars, beginning and ends of curves, spirals, tapers, tangents, cut-offs, radii, etc.

- complete cross-section dimensions (i.e. width of pavement on each side of the centreline, the total width or widths of pavement, boulevards, medians, sidewalks, rights-of-way, etc.) to be placed on the plan view of each sheet or at each change in the cross-section. The back of curb or outside limit of pavement should be used for dimensioning purposes.

- all information necessary for field layout of the pavement within the right-of-way such as curve and spiral data, amount of taper, coordinate information, azimuths, chainage ties, etc. should be tabulated on each drawing, or referenced to a special curve information sheet.

- All street and lane turnout radii and median nose radii marking the beginning and ends of curves and points of compound curve must be identified.

- for horizontal scales, see vertical alignment.

Vertical Alignment (Pavement Elevations and Profiles)

This category includes all information necessary for setting the grade of the proposed roadway and its relationship to existing features. Pavement elevations and profiles are usually combined in a plan-profile arrangement, although in some cases, profiles may have to be on separate sheets, because of large differences in elevations. The guidelines for presentation of information under this category are as follows:

- in the case of asphalt overlays, pavement reconstruction, pavement widening and miscellaneous improvements, the horizontal scale must be 1:200 or 1:250 and the vertical scale 1:10. New pavements must be drawn using a horizontal scale of 1:200 or 1:250 with a vertical scale of 1:20, however, a scale of 1:500 may be used for drawings with a right-of-way of 30 metres or more where it would become too cumbersome at a large scale. In the event that a scale of 1:500 is used, a scale of 1:200 or 1:250 must still be used for details such as intersections.

- the profile stationing should be aligned vertically with the plan stationing if possible.

- on vertical curves, chainages should be provided at the Beginning of Vertical Curve, the Point of Vertical Intersection, the End of Vertical Curve and all calculated elevation points.

- in general, the profile control for pavement will be the drainage gutter.

- all elevations must be referenced to geodetic bench marks.

- relevant bench marks should be shown on each sheet.

- Locations and elevations of all existing controlling features such as curbs, public and private sidewalks, door sills, driveways, garage floors, etc. must be clearly indicated.

- generally, proposed pavement grades should be illustrated at:

  - grade changes
  - drainage points
  - 10 m intevals on vertical curves
  - 5 m intervals on superelevation transitions
  - intersections as required to adequately describe the surface

- indication of curb elevations is unnecessary unless required by variations from the standard cross-section.

- metric elevations shall be shown to three decimal places. Although it is not expected that grades will be set to 1 mm accuracy they can be set to 5 mm accuracy requiring three decimal places.

Requirements for Pavement Resurfacing Drawings

The importance of having complete information on existing controlling features is stressed. The elevations and locations of adjacent features are extremely important in assessing the proposed design as well as facilitating the constant checking which must be done by field layout personnel.

For roadway resurfacing drawings, the required information is as follows:

- in the case of pavement resurfacing drawings, existing elevations are to be shown at 15 m intervals longitudinally and at longitudinal joints or traffic lane divisions transversely. Proposed elevations are shown at drainage locations and profile break points longitudinally and at longitudinal joints, or lane divisions transversely. Sufficient existing elevations should be provided along intersecting roadways to determine the direction of drainage.

- indicate the percent of gradient on profiles showing proposed grades.

- indicate direction of drainage along gutters, around corner radii, etc.

- include geometric data, if specifically requested by originating department.

Paving and Grading

Information included under this topic includes description and limits of pavement and curb types, earth grading design, surface drainage, and pavement joints. Recommended guidelines are as follows:

- indicate specific limits for various existing surface or pavement types. In the case of resurfacings, indicate specific limits for joint repairs and panel replacements, if possible.

- design longitudinal joints to correspond with the proposed traffic lanes. Pavement joint lines must be indicated at intersections, but may be dispensed with on regular sections of pavement between intersections.

- define all existing pavements which abut or intersect the proposed pavement.

- earth grading may be depicted by the contour method, or the slope line methods, although the contour method is preferred.

- show all ditches and indicate the direction of flow.

Cross-Sections

Typical and special cross-sections are required to clearly define the relationship of the proposed pavement, curbs, base course shoulder ditches, sidewalks, medians, etc., to one another and to the existing right-of-way and surface. Generally roadway cross-sections should be drawn at a horizontal scale of 1:100 and a vertical scale of 1:50. Some details may require greater distortion but N.T.S. cross-sections should be avoided.

- indicate percentage of crossfall
- indicate percentage of superelevation

Standard and Special Details

Standard details are included in the City's "Standard Construction Specifications" manual. Reference to the standard detail number should be made on the plan, i.e. C & G inlet SD-223-A.

Special details are, of course, as required by the project and at the discretion of the designing agency. They may or may not be grouped depending on the magnitude of the project.

Drainage and Utilities

In illustrating drainage facilities, the following procedure should be followed:

- provide chainage and offset (or coordinates) for all manholes, catch basins, curb inlets, catch pits, etc. Also provide top and invert elevations.
- for drainage connections indicate pipe size, type, length, invert elevation, and grade.
- indicate scale ratio.

Landscaping and Irrigation

Information to be included under this category should be as follows:

- disposition of affected trees and irrigation equipment.
- specific limits for the various types of landscaping (i.e., sodding, grading, and seeding, etc.)
- specific description of location and types of irrigation equipment.
- indicate scale ratio.

Gas Pipeline Warning

The gas pipeline warning, in the form of a "stick-on" as shown below shall be placed on all drawings which indicate any type of work requiring the use of power equipment or explosives in the vicinity of any gas pipeline.

WARNING

IF POWER EQUIPMENT OR EXPLOSIVES ARE TO BE USED FOR EXCAVATION ON THIS PROJECT THE CONTRACTOR MUST:

1) NOTIFY THE GAS COMPANY OF THE PROPOSED LOCATION OF EXCAVATION.

2) TAKE PRECAUTION TO AVOID DAMAGE TO GAS COMPANY INSTALLATIONS.

SEE PROVINCIAL REGULATION 210/72 FOR DETAILS

Survey Monuments

In producing all design drawings for the City of Winnipeg, the consulting firms and inhouse design departments must ensure that the survey monument plant is located accurately on the drawing. This information is to be derived from registered legal survey plans for survey bar location, the City of Winnipeg Bench Mark Booklet for bench marks location and the Land Surveys and Real Estate Department for the location of horizontal control monuments.

SPECIAL REQUIREMENTS FOR DISTRICT OPERATIONS

As-Constructed Drawings.

The following information is to be shown:

- All service connections are to be shown in their entirety and in their as-constructed location on the plan.
- Measurements for service connection locations are to be recorded on the standard charts in the format described below.
- All service locations (corporation and stop, junction and property line location) are to be shown as longitudinal measurements along the respective mains.
- All measurements are to be tied into at least two references.

  References shall be:
  a) Valves and hydrants for water services.
  b) Manholes for sewer services.
- Property line and stop cock location of services shall be shown as the perpendicular distance from the respective mains.
- Sewer connection inverts at property line shall be shown.
- All service measurements are to be shown in conventional terminology, and not as chainages from stations.
- Where the situation requires (such as cul-de-sacs), measurements may be taken from a straight line projection of the respective mains. Where the situation requires additional information, or a modified format to provide clarity, the record information shall be provided as directed by the District.

A complete material list shall be shown and will include the following:

- Manufacturer's name.
- Manufacturer's identification and number of the product.
- Type of material.
- Valve turns.

EXAMPLES OF STANDARD CHARTS FOR SERVICE CONNECTION LOCATIONS.

SEWER CONNECTION DATA

REF.	JCT. LOC.	℄ LOC.	OFFSET FROM MAIN	INV. AT ℄
M.H. at STA. 1+22	0			
LOT 1	10			
2	30			
3	40			
4	50			
5	67			
M.H. at STA. 2+00	78/0			
LOT 8	10			
9	12			
10	24			

WATER CONNECTION DATA

REF.	CORP. LOC.	STOP LOC.	STOP OFFSET FROM MAIN
HYD. at STA. ---	0		
LOT 1	20		
2	40		
VALVE at STA. 0+60	60/0		
3	20		
4	40		
5	60		
HYD. at STA. 1+40	80/0		

SPECIAL REQUIREMENTS FOR THE STREETS AND TRANSPORTATION DEPARTMENT

The construction drawing standards outlined in this manual describe the civil works drawing requirements for the City of Winnipeg in general, however, the following procedures are to be adhered to in the production of drawings for the Streets and Transportation Department:

- the drawings shall be prepared using technical pens with mechanical lettering devices to ensure consistency of quality and appearance.

- the drawings must indicate the extent of work actually completed and the layout details which apply thereto. Geometric conditions before construction are not to be removed from the "as-constructed" drawings.

- all work actually completed is to be shown on the "as constructed" drawings.

- "as constructed" drawings are to be identified as such by a "stick-on" worded as shown below.

REVISED AS CONSTRUCTED
DATE _____ BY _____
CHECKED BY _____

- where a monolithic median is constructed, dimension the full width of the pavement from back of curb to the outside limit of the pavement under the median, the width of the monolithic median and the amount of overlap of the monolithic median on the pavement. See figure 11 (a).

- where a monolithic island is constructed, dimension the full width of the pavement from the back of the curb to the outside limit of the pavement under the island and the amount of overlap of the island on the pavement. Also dimension the concentric radius to the face of the island and the offsets. See figure 11 (b).

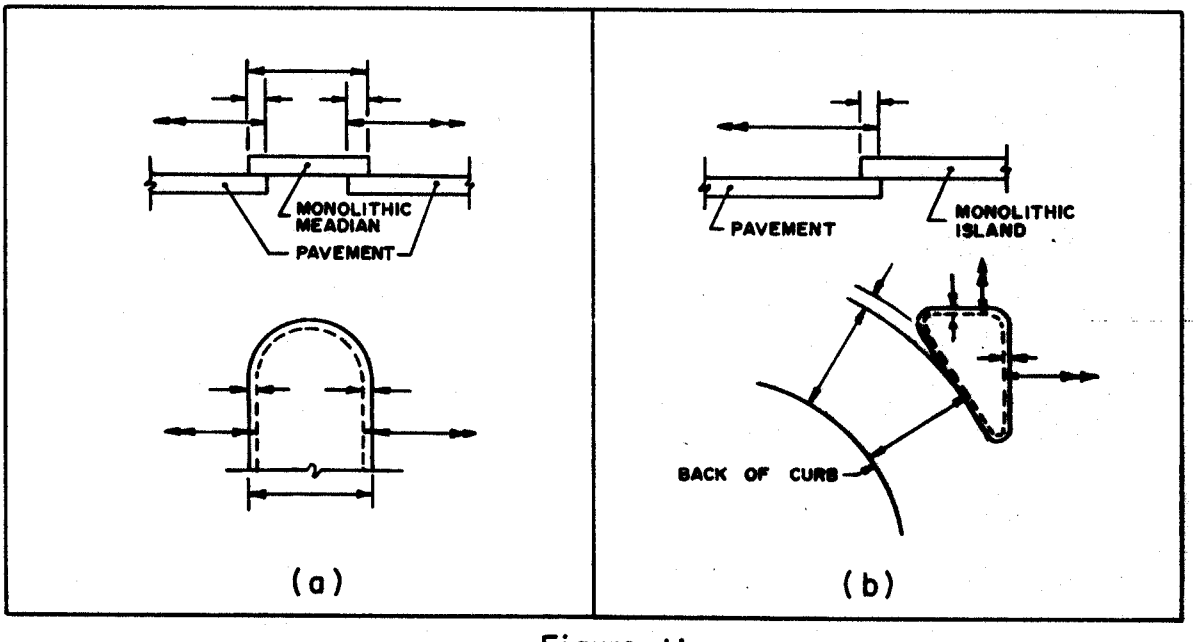


Figure 11

SPECIAL REQUIREMENTS FOR WATERWORKS, WASTE AND DISPOSAL DEPARTMENT

The construction drawing standards described in parts 1 to 3 of this manual apply to all civil works drafting, assigned by this Department, relating to Waterworks, Waste Wastewaterworks, Land Drainage and Solid Waste Disposal Facilities.

All drawings for treatment plants, pumping stations, landfill operations, reservoirs and structures are to conform with the National Research Council of Canada's Manual of Metric Drawing Practices No. N.R.C.C. 15234. In addition to the drawing practices, the preparation of design drawings shall be to the following Waterworks, Waste and Disposal Department's drafting requirements that allow the Department to call tenders for the completed construction of the design. The drawings shall be prepared using technical ink pens with mechanical lettering devices to ensure the consistency of quality and appearance.

Prior to the preparation of the complete drawing set, the consultant shall submit the first drawing of the set to the Director to ensure that the Consultant understands the drafting requirements of the Department. The remaining drawings shall not be completed until approval of the first print is received from the Director.

Existing drawings of Facilities may be used for informational purposes only, and the drawings shall be marked "For Information Only". Design drawings prepared by the modification of second generation originals of existing drawings will not be allowed.

SHADING ON DRAWINGS

Shading material for all drawings shall be Letraset Pantone number 319A. Additional shading shall only be applied upon the approval by the Project Engineer. Examples of additional shading shall be submitted for approval in full size and one half size reductions, meeting microfilming requirements for legibility and density.

SHOP DRAWINGS (Manufacturer's Drawings)

The Consultant shall ensure that all shop drawings are clear, concise, and complete.

AS-CONSTRUCTED DRAWINGS

Upon Project Completion, as-constructed drawings shall be submitted and shall consist of:

a) Original mylar drawings revised "as-constructed" worded in the past tense, and bearing department facility drawing file numbers. The drawings shall be signed by the Project Engineer to acknowledge and confirm the construction has been completed, and the drawings conform to the completed construction.

b) All last revision reproducible or white print shop drawings, manuals or instructions, properly marked and cross-referenced with Department manufacturer's drawing numbers to the original mylar drawings.

c) A separate list of all electrical installation drawing numbers complete with a cross-reference to operational instruction and manuals.

Revision Guidelines

Revision guidelines for "as-constructed" drawings for reservoirs, treatment plants, pumping stations, control structures and landfill site buildings etc. to be as follows:

Assemble all information and data relating to the project i.e. Construction drawings, manufacturer's drawings, project photographs, design notes, inspectors reports specifications and operating manuals relating to the construction.

Organize the information according to disciplines of site, architectural, structural, mechanical and electrical for ease of reference.

From the field drawings supplied by the General Contractor; revise the drawings to "As-Constructed" in accordance with the following steps:

a) Remove "proposed" or "new" notations or redundant construction notes.

b) Show all abandonments, or changes to existing facility drawings.

c) Word notations in the past tense and remove temporary conditions for construction purposes.

d) Revise elevations, chainages and measurements from field drawings and survey information.

e) Call up any special construction methods or materials.

f) Reference to previous construction drawings.

g) Cross-reference manufacturer's drawings to the construction drawings.

h) Show signed stamp and specific notation in reference to the construction.

"As-Constructed"

Approved by _____

As-Constructed approval applies only to the - (Title of Constructed Facility of Installations).

UNDERGROUND STRUCTURES PROPOSED CONSTRUCTION DRAWING APPROVAL AND ASSOCIATED CIRCULATION PROCEDURES

The main function of the Underground Structures Section is to coordinate placement and construction of various utilities within the public rights-of-way in order to attain optimum utilization of that space, eliminate conflicts in timing of various projects, and minimize damage to street pavements. In order to minimize design problems which may be experienced by various initiating engineering offices (City, Consultants or Utilities) in that regard, this Section maintains an up-to-date file of pavement and utility as-built drawings which are available to anyone on request.

On the other hand, it is not the function of the Underground Structures Section to approve the engineering design of various services, only their location. The approval circulation process sponsored by this Section involves all necessary City departments, but does not directly include the three major Public Utilities or the Waterworks, Waste and Disposal Department, because this Section acts on their behalf in regard to the location of their services. However, preliminary drawings which deal primarily with engineering design, should be sent to the pertinent offices independently for design approval, prior to the final circulation. The Underground Structures Section will not interfere with such a preliminary drawing approval process, because design co-ordination is not their function; as opposed to utility plant location approval, which is.

The location approval is generally based on compliance with a set of Imperial and/or Metric Standards for placement of utilities within all public rights-of-way ("Standard Locations"), which designate specific and individual vertical offsets from the property line for all individual services. These Standards were drafted and adopted by the Underground Structures Committee in 1974 and are, whenever possible, compulsory for design of all public services. All departures from these Standards, or design of services on rights-of-way widths not specified in the Standards may be granted, but only after a special review. The depths of plant are not specified in the Standards, because in most cases, they are governed by preponderant engineering requirements (depth of frost, gradient, depth of bed rock, etc.), which may vary

from one location to another. There is, however, one exception, which only applies to the Gas Co., whereby the minimum depths of their lines are controlled by government regulation (The Gas Pipeline Act); specifically, 24 inches of cover for gas mains, and 18 inches of cover for gas service lines (house connections). For "Standard Locations" drawings see pages 4-15 to 4-22.

All parties involved with any construction within public rights-of-way (which includes Streets and Transportation Department, Waterworks, Waste and Disposal Department and all City of Winnipeg District Engineering Offices), as well as all land developers and Engineering, Architectural and Planning Consultants, in addition to all Public Utilities, shall submit drawings showing their proposed work, directly to this Section for approval and file.

These drawings will subsequently be circulated by this Section to other parties involved: (e.g. Regional Streets, Streets and Transportation Department and District Offices). Ultimately, following any necessary revisions, and following approval by all pertinent agencies and departments, the Underground Structures Section will retain two approved and signed copies, one to be kept on file and one to be returned to the originating offices for construction. It is suggested that under normal circumstances, at least three weeks be allowed for this circulation process.

Since the various City Engineering Offices have specific and varied file requirements, it is requested that the number of copies submitted to the Underground Structures Section be as follows:

1) Services on Regional Streets (with or without District involvement) - 6 copies. (See flow chart "A")

2) Services on District Streets only - 4 copies. (See flow chart "B")

3) All submissions of drawings which have been previously approved by the District and contain the District Engineer's signature, can be reduced by two copies.

The above three items apply only to drawings produced by Engineering Consulting firms, the three Utilities (gas, hydro, and telephone), and other

"outside" agencies. The following two items apply to drawings produced by the City of Winnipeg Engineering Offices only:

4) Services on Regional Streets (with or without District involvement) - 5 copies. (See flow chart "C")

5) Services on District Streets (and previously signed by the District Engineer) - 2 copies.

Should any office wish to submit original drawings for approval (sepias, mylars, linens, etc.) instead of the specified number of prints, one set of prints must be included for Underground Structures' records.

PLAN APPROVAL CIRCULATION PROCEDURE

Chart "A"

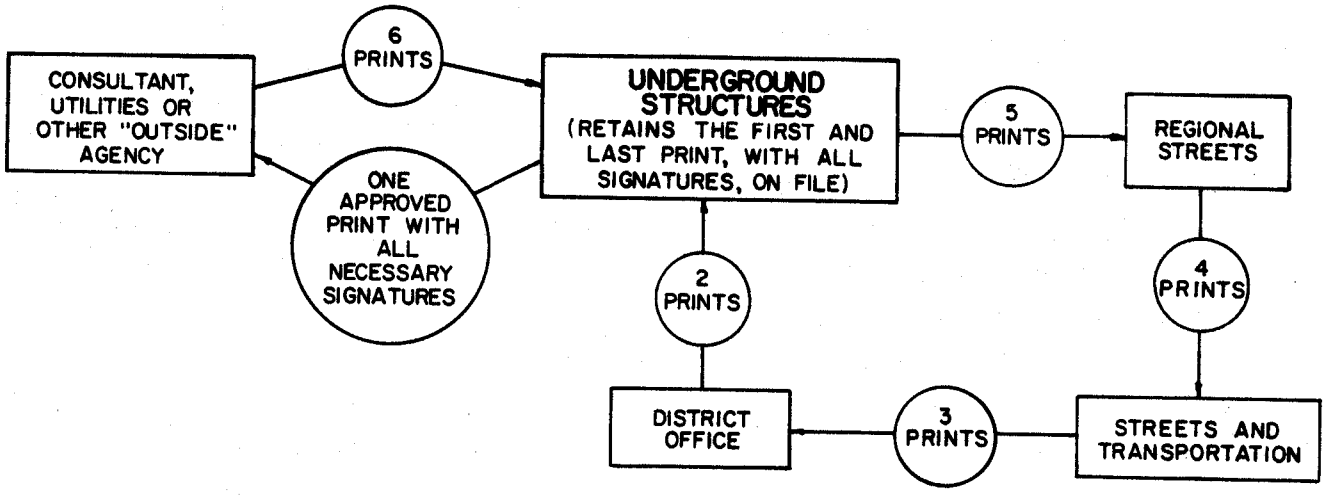


Chart "B"

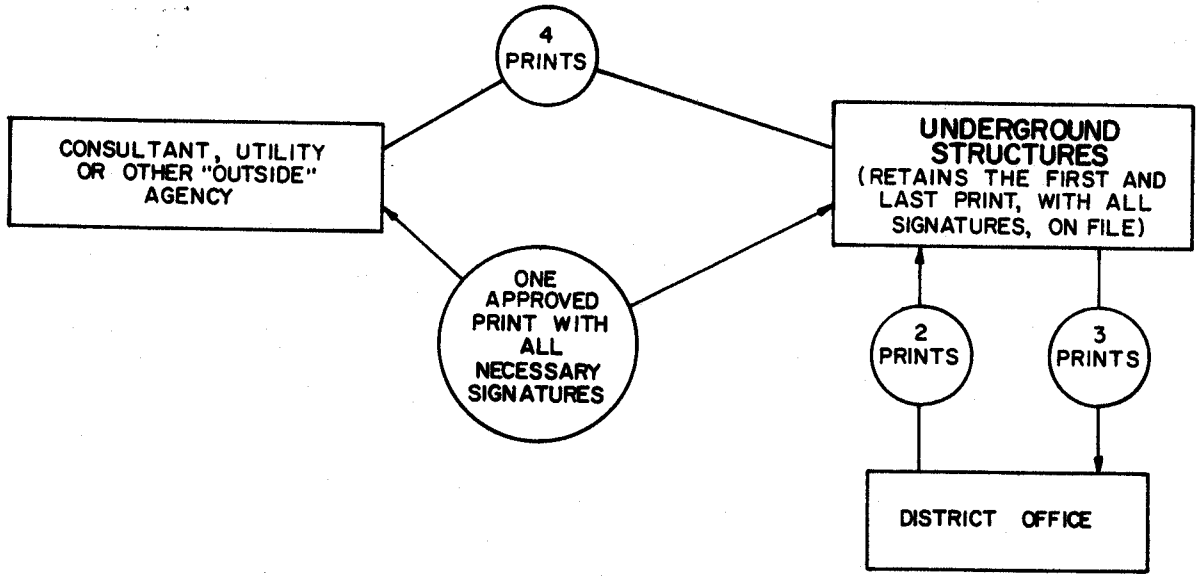


Chart "C"

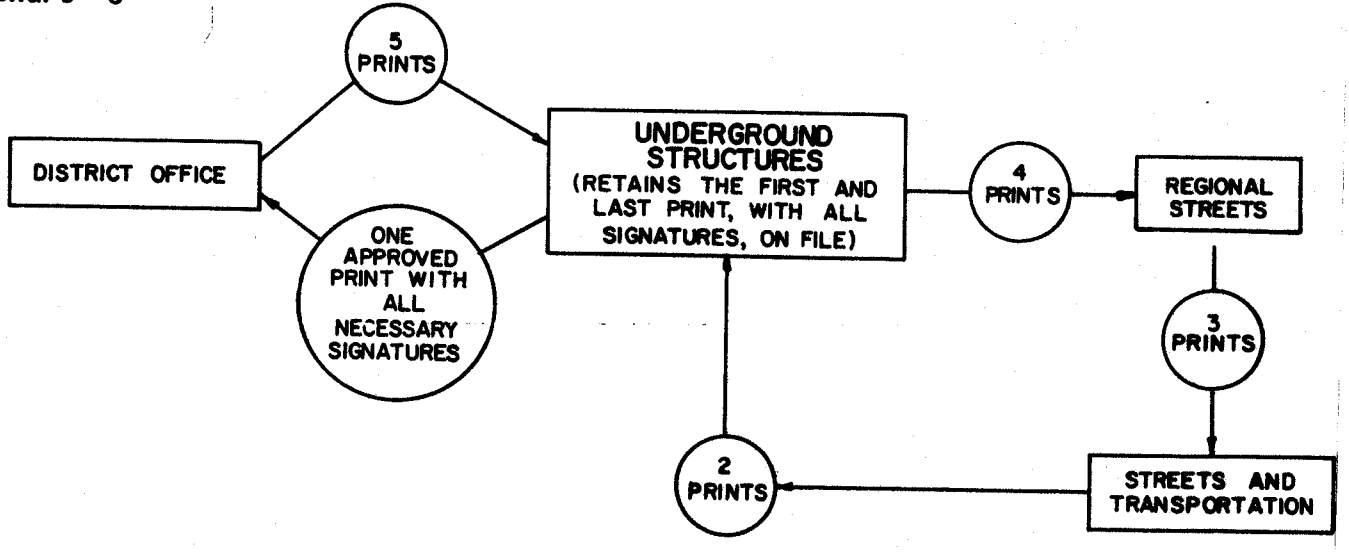
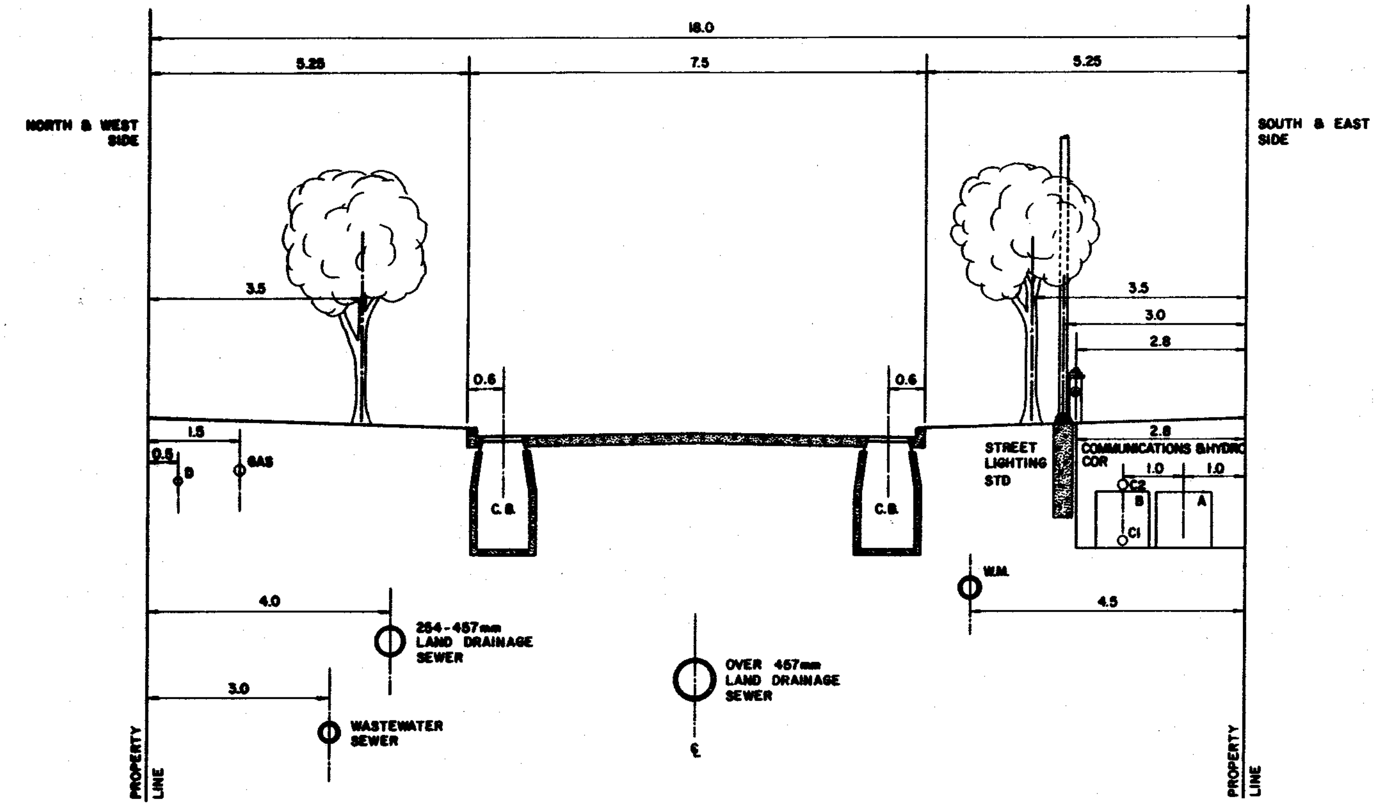


Figure 12



METRIC

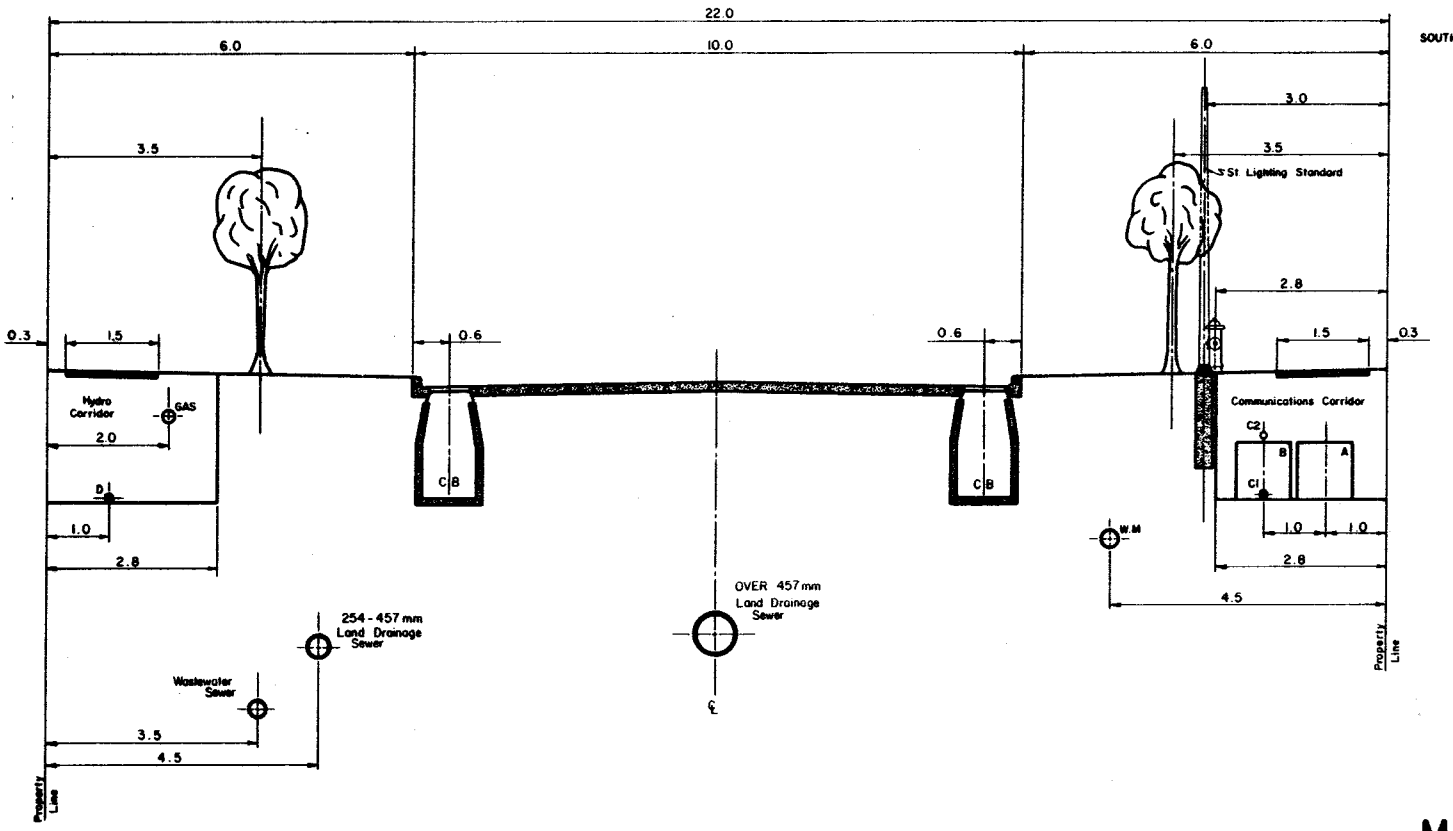
NOTES	REVISIONS
1. 2.8 SPACE ALLOTMENT FOR HYDRO AND COMMUNICATIONS CORRIDORS ARE FOR MANHOLE INSTALLATION ONLY. OTHER UTILITIES INSTALLED WITHIN THE CORRIDOR WILL BE SO CONSTRUCTED AS TO AVOID CONTACT WITH THE MANHOLES. 2. ORDER OF CONSTRUCTION WITHIN THE COMMUNICATIONS & HYDRO CORRIDOR: A. FIRST DUCTLINE INSTALLATION. B. SECOND DUCTLINE INSTALLATION. C1 & C2 – ORDER OF DIRECT CABLE BURIAL INCLUDING STREET LIGHTING CABLE. 3. ADDITIONAL M.T.S. OR HYDRO DIRECT CABLE BURIAL AT "D."	1. NOTE CHANGE 80-02-21

APPROVED
UNDERGROUND STRUCTURES COMMITTEE
DATE DEC 20/79 CHAIRMAN SECRETARY

CITY OF WINNIPEG UNDERGROUND STRUCTURES	STANDARD LOCATIONS FOR UTILITY STRUCTURES	18m LOCAL RESIDENTIAL STREET	DRAWN BY: BK 79-12-12 CHECKED BY: SCALE: 1:50	M-1

JAN 84

Figure 13



METRIC

NOTES

1. ADDITIONAL M.T.S. OR HYDRO DIRECT CABLE BURIAL AT "D"
2. 2.8 SPACE ALLOTMENT FOR HYDRO AND COMMUNICATIONS CORRIDORS ARE FOR MANHOLE INSTALLATION ONLY
   OTHER UTILITIES INSTALLED WITHIN THE CORRIDOR WILL BE SO CONSTRUCTED AS TO AVOID CONTACT WITH THE MANHOLES.
3. ORDER OF CONSTRUCTION WITHIN THE COMMUNICATIONS & HYDRO CORRIDOR:
   A. FIRST DUCTLINE INSTALLATION.
   B. SECOND DUCTLINE INSTALLATION.
   C1 & C2 - ORDER OF DIRECT CABLE BURIAL INCLUDING STREET LIGHTING CABLE.

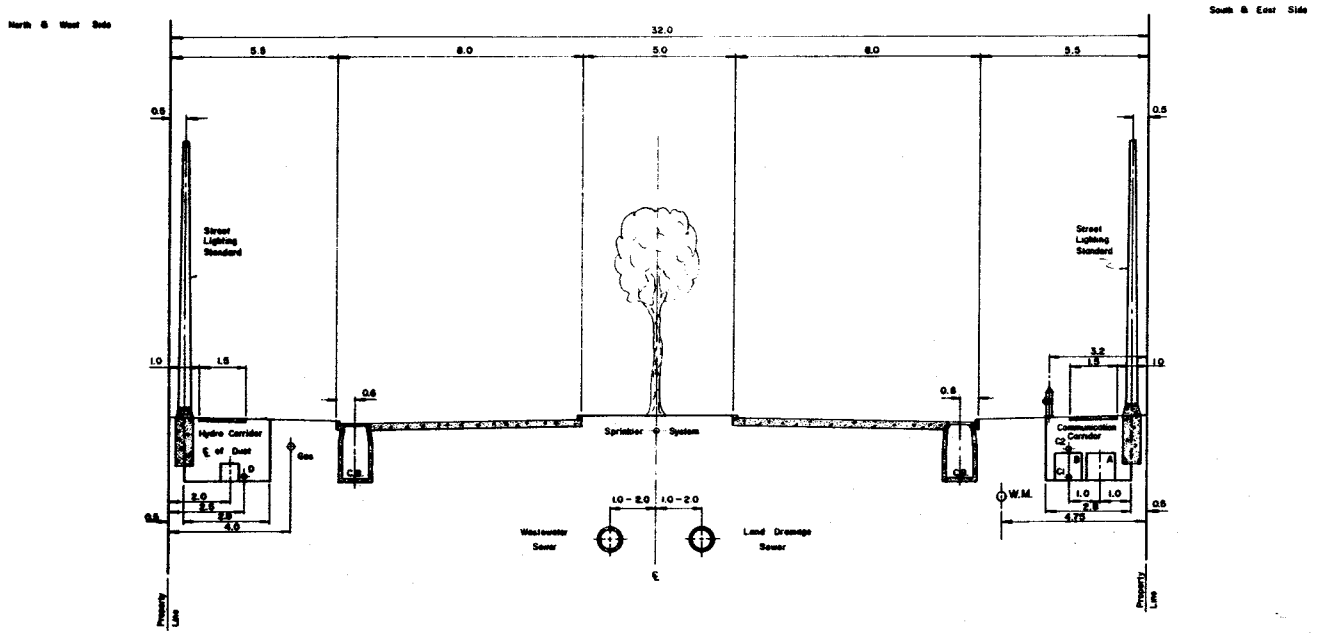
APPROVED
UNDERGROUND STRUCTURES COMMITTEE
DATE DEC. 20/79 CHAIRMAN
SECRETARY

REVISIONS

1 NOTE CHANGE 79-12-14
2 NOTE CHANGE 80-02-21

CITY OF WINNIPEG UNDERGROUND STRUCTURES	STANDARD LOCATIONS FOR UTILITY STRUCTURES	22m LOCAL INDUSTRIAL or RESIDENTIAL COLLECTOR	DRAWN BY: RMS 79 01 05 CHECKED BY: SCALE: 1:50	M-2

JAN 84



METRIC

NOTES

1. 2.8 SPACE ALLOTMENT FOR HYDRO AND COMMUNICATIONS CORRIDORS ARE FOR MANHOLE INSTALLATION ONLY.
   OTHER UTILITIES INSTALLED WITHIN THE CORRIDOR WILL BE SO CONSTRUCTED AS TO AVOID CONTACT WITH THE MANHOLES.
2. ORDER OF CONSTRUCTION WITHIN THE COMMUNICATIONS & HYDRO CORRIDOR:
   A. FIRST DUCTLINE INSTALLATION.
   B. SECOND DUCTLINE INSTALLATION.
   C1 & C2 - ORDER OF DIRECT CABLE BURIAL INCLUDING STREET LIGHTING CABLE.
3. ADDITIONAL M.T.S. OR HYDRO DIRECT CABLE BURIAL AT "D".
4. LOCATION OF WASTEWATER AND LAND DRAINAGE SEWERS COULD BE INTERCHANGED.

DEC. 20/79

REVISIONS

1.	NOTE CHANGE	80-02-21
2.	ALIGN. W.M.	80-12-16
3.	REVISE TITLE	83-05-05

CITY OF WINNIPEG UNDERGROUND STRUCTURES	STANDARD LOCATIONS FOR UTILITY STRUCTURES	32 m MINOR ARTERIAL STREET	DRAWN BY: WW 79-12-12 CHECKED BY: SCALE: 1:100	M-3

JAN 84

Figure 15

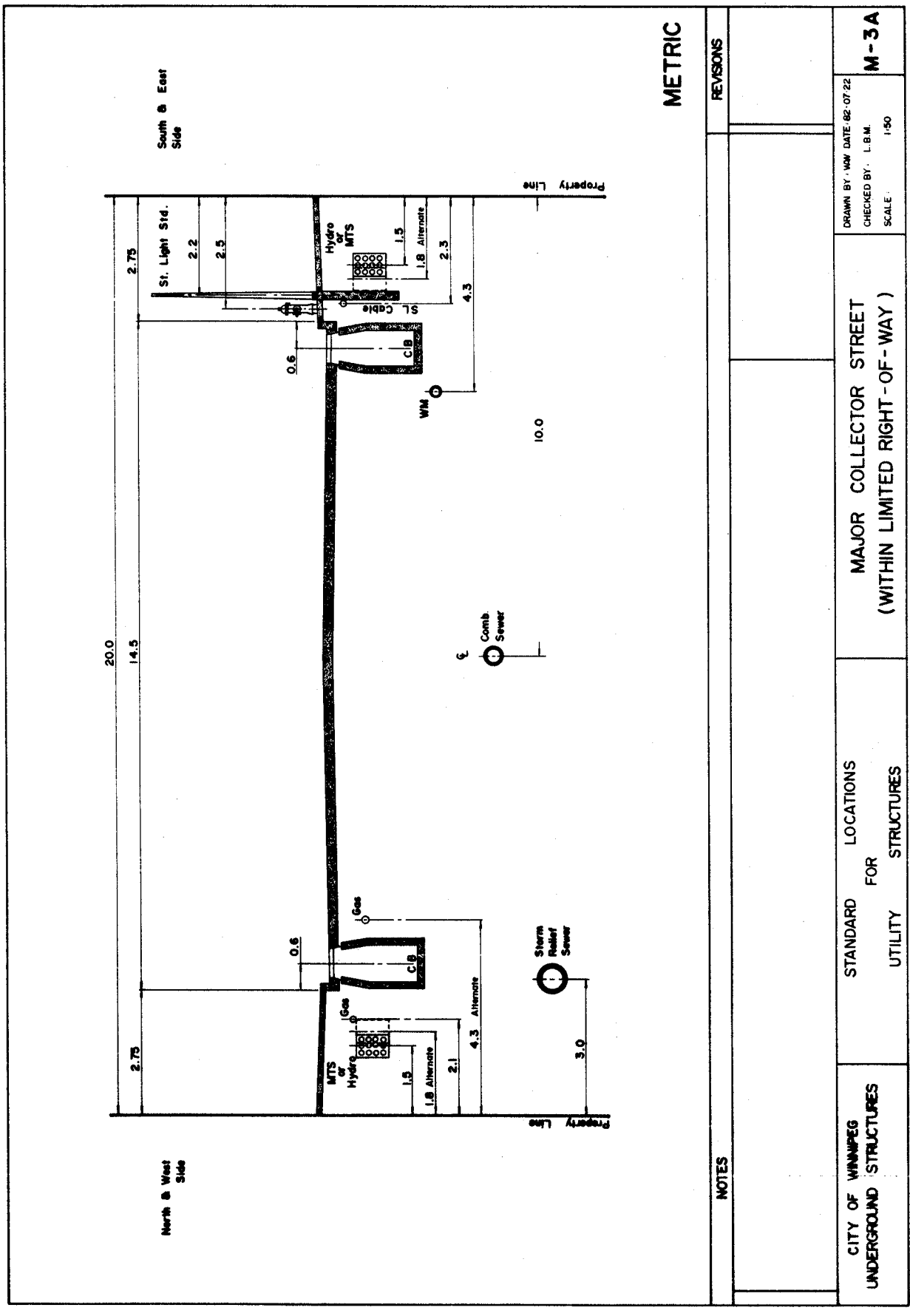
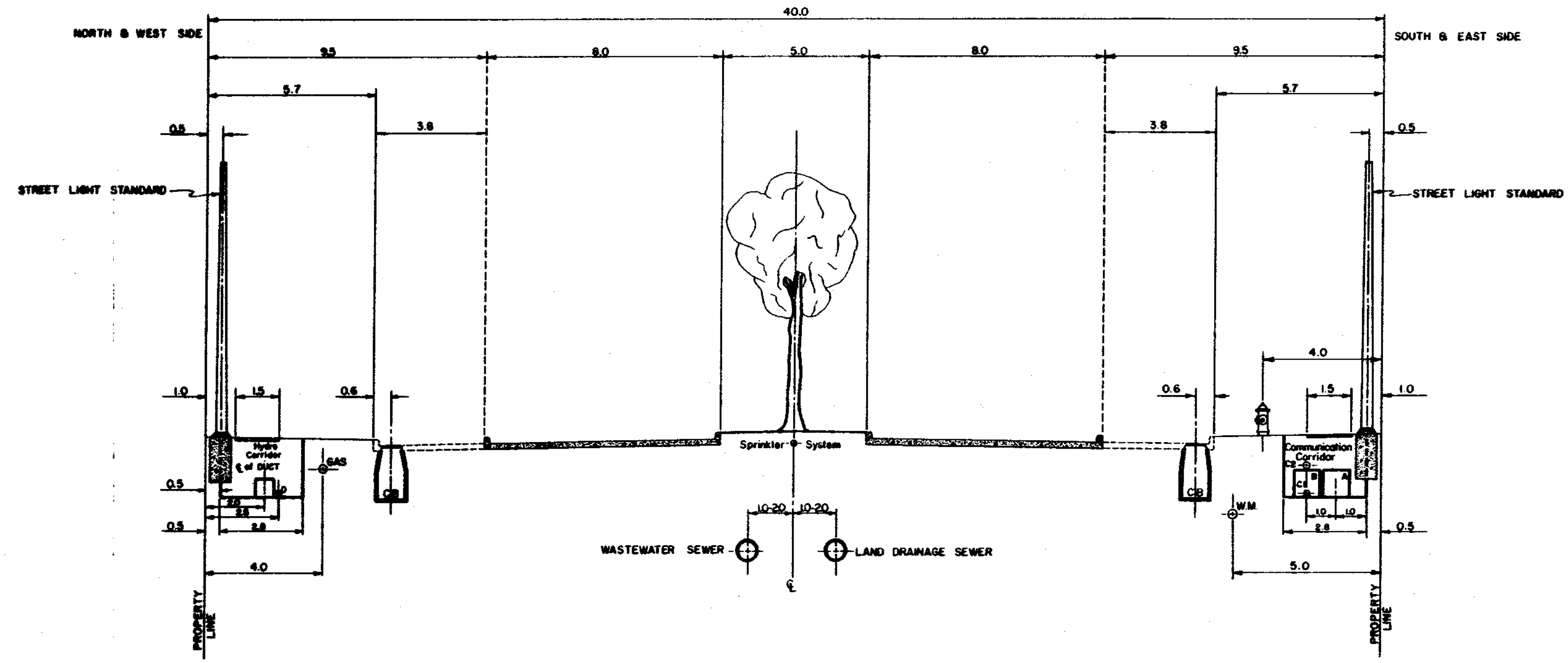

METRIC
South & East Side
North & West Side
Property Line
Property Line
St. Light Std.
2.75
2.2
2.5
Hydro or MTS
1.5
1.8 Alternate
2.3
4.3
SL Cable
C.B.
0.6
WM
10.0
Comb. Sewer
20.0
14.5
Gas
0.6
C.B.
Gas
MTS or Hydro
1.5
1.8 Alternate
2.1
4.3 Alternate
Storm Relief Sewer
3.0
2.75
NOTES
REVISIONS
CITY OF WINNIPEG
UNDERGROUND STRUCTURES
STANDARD LOCATIONS FOR UTILITY STRUCTURES
MAJOR COLLECTOR STREET
(WITHIN LIMITED RIGHT-OF-WAY)
DRAWN BY - WW DATE- 82-07-22
CHECKED BY - L.B.M.
SCALE - 1:50
M-3A
JAN 84

Figure 16



METRIC

NOTES

1. LOCATION OF WASTEWATER AND LAND DRAINAGE SEWERS COULD BE INTERCHANGED.
2. 2.8 SPACE ALLOTMENT FOR HYDRO AND COMMUNICATIONS CORRIDORS ARE FOR MANHOLE INSTALLATION ONLY. OTHER UTILITIES INSTALLED WITHIN THE CORRIDOR WILL BE SO CONSTRUCTED AS TO AVOID CONTACT WITH THE MANHOLES.
3. ORDER OF CONSTRUCTION WITHIN THE COMMUNICATIONS & HYDRO CORRIDOR·
   A. FIRST DUCTLINE INSTALLATION.
   B. SECOND DUCTLINE INSTALLATION.
   C1 & C2 - ORDER OF DIRECT CABLE BURIAL INCLUDING STREET LIGHTING CABLE.
4. ADDITIONAL M.T.S. OR HYDRO DIRECT CABLE BURIAL AT "D"

APPROVED
UNDERGROUND UTILITIES COMMITTEE
DATE DEC 20/79
CHAIRMAN
SECRETARY

REVISIONS

1. NOTE CHANGE 79·12·14
2. NOTE CHANGE 80·02·21

CITY OF WINNIPEG
UNDERGROUND STRUCTURES

STANDARD LOCATIONS FOR UTILITY STRUCTURES

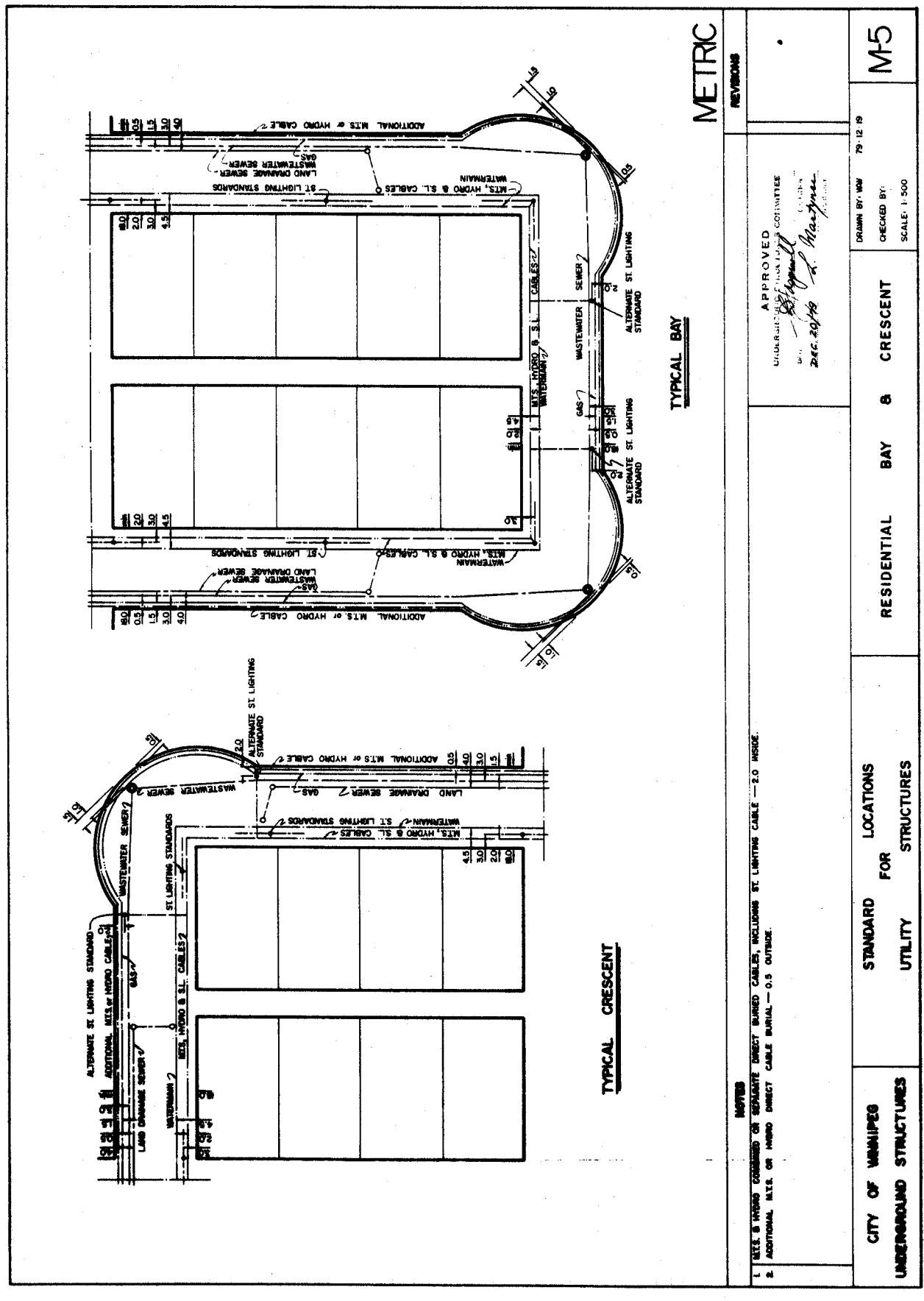
40m MAJOR ARTERIAL STREET

DRAWN BY: RMS 79 01 04
CHECKED BY:
SCALE: 1:100

M-4

JAN 84

Figure 17


METRIC
TYPICAL BAY
TYPICAL CRESCENT
NOTES
1. M.T.S. & HYDRO COMBINED OR SEPARATE DIRECT BURIED CABLES, INCLUDING ST. LIGHTING CABLE — 2.0 INSIDE.
2. ADDITIONAL M.T.S. OR HYDRO DIRECT CABLE BURIAL — 0.5 OUTSIDE.
REVISIONS
APPROVED
DEC. 20/78
CITY OF WINNIPEG
UNDERGROUND STRUCTURES
STANDARD LOCATIONS FOR UTILITY STRUCTURES
RESIDENTIAL BAY & CRESCENT
DRAWN BY: WW 79 12 19
CHECKED BY:
SCALE: 1:500
M-5
JAN 84

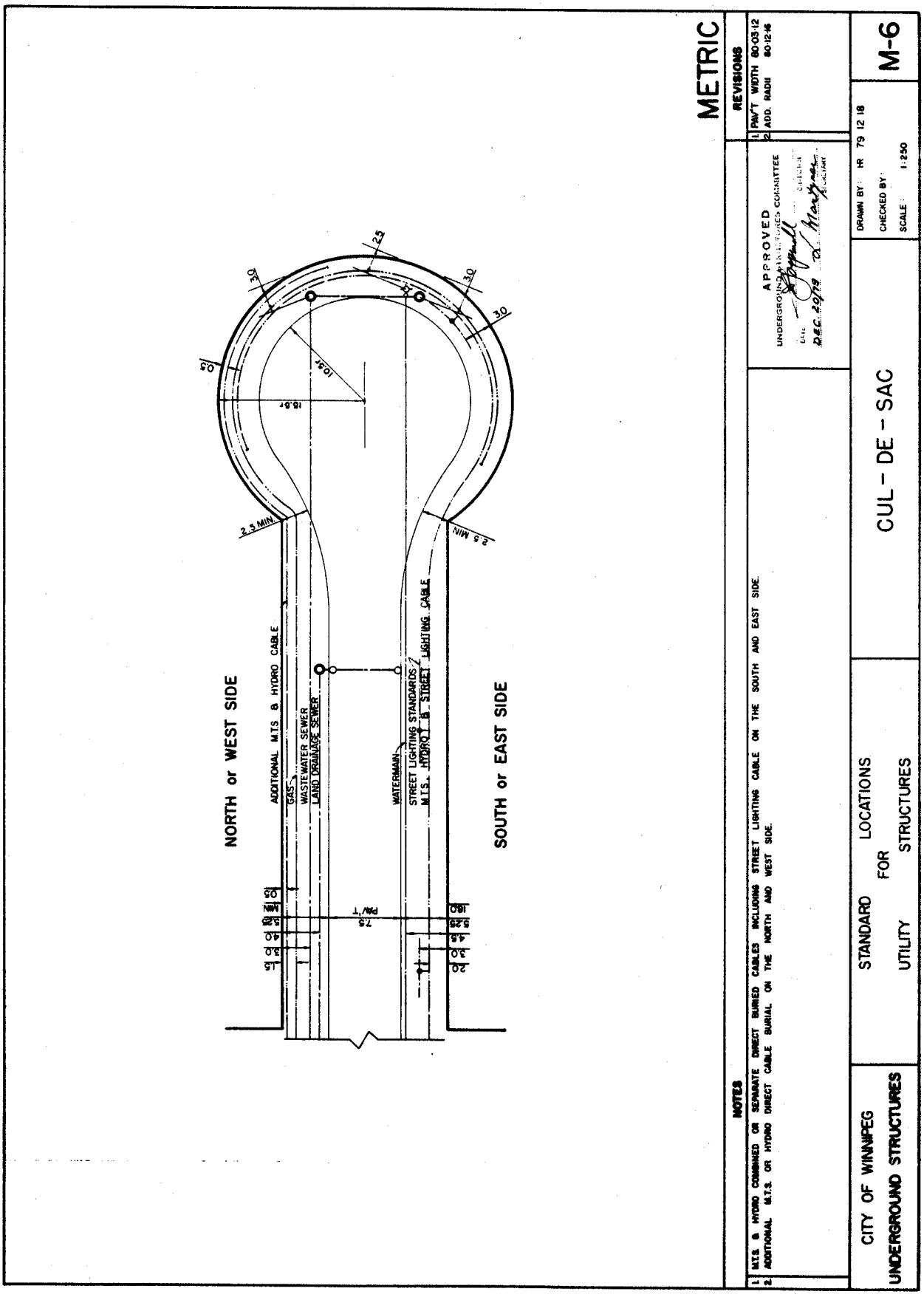
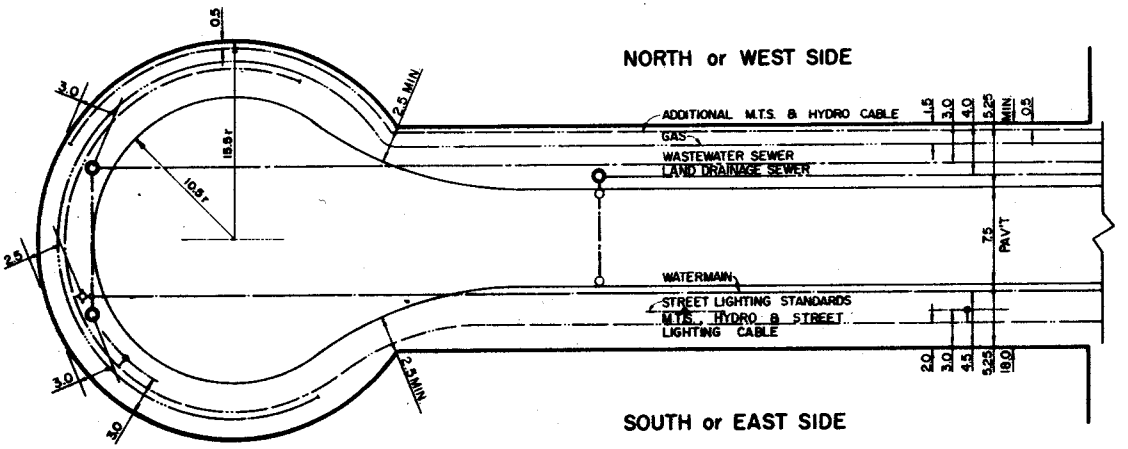

METRIC
REVISIONS
1 PAV'T WIDTH 80-03-12
2 ADD. RADII 80-12-16
APPROVED
UNDERGROUND SERVICES COMMITTEE
Chairman
Secretary
DRAWN BY: HR 79 12 18
CHECKED BY:
SCALE: 1:250
JAN 84
M-6
NOTES
1 M.T.S. & HYDRO COMBINED OR SEPARATE DIRECT BURIED CABLES INCLUDING STREET LIGHTING CABLE ON THE SOUTH AND EAST SIDE.
2 ADDITIONAL M.T.S. OR HYDRO DIRECT CABLE BURIAL ON THE NORTH AND WEST SIDE.
CITY OF WINNIPEG
UNDERGROUND STRUCTURES
STANDARD LOCATIONS FOR UTILITY STRUCTURES
CUL - DE - SAC
NORTH or WEST SIDE
SOUTH or EAST SIDE
ADDITIONAL M.T.S. & HYDRO CABLE
GAS
WASTEWATER SEWER
LAND DRAINAGE SEWER
WATERMAIN
STREET LIGHTING STANDARDS
M.T.S. HYDRO & STREET LIGHTING CABLE
PAV'T
7.5
2.5 MIN
2.5 MIN
10.5r
15.5r
25
30
30
30

Figure 19



METRIC

NOTES

1. M.T.S. & HYDRO COMBINED OR SEPARATE DIRECT BURIED CABLES INCLUDING STREET LIGHTING CABLE ON THE SOUTH AND EAST SIDE.
2. ADDITIONAL M.T.S. OR HYDRO DIRECT CABLE BURIAL ON THE NORTH AND WEST SIDE.

APPROVED
UNDERGROUND STRUCTURES COMMITTEE
DATE Dec. 20/79 CHAIRMAN
SECRETARY

REVISIONS

1. R/W/T WIDTH 80-03-12
2. ADD. RADII 80-12-16

CITY OF WINNIPEG **UNDERGROUND STRUCTURES**	STANDARD LOCATIONS FOR UTILITY STRUCTURES	CUL - DE - SAC	DRAWN BY: HR 79 12 18 CHECKED BY: SCALE: 1:250	M-7

JAN 84