INTRODUCTION

In 1988 Congress enacted the Omnibus Trade and Competitiveness Act which among other things:

1 - Declared the metric system the preferred system of weights and measures for U.S. trade and commerce.

2 - Required each federal agency to convert to the metric system for procurements, grants, and business related activities.

In 1991 President Bush issued an Executive Order which basically directed federal agencies to convert to metric under the leadership of the Secretary of Commerce and they were to do so within a fixed period of time.

As a consequence, the Federal Highway Administration developed an implementation plan which was intended to lead to complete metrication by September 30, 1996. Their intent was to have the Plan, Specification and Estimate assemblies for all federal-aid projects in metric units after that date. The September 1996 deadline was extended to September 2000 after the National Highway System (NHS) Designation Act was signed in November 1995.

The Location and Design Division initiated metric survey and plan development in 1993 to meet FHWA's date for advertisement. All projects that have not already been surveyed will be surveyed and designed in metric.

This volume of the Road Design Manual is being distributed to provide guidance in the Department's requirements for metric plan development. The information being provided at this time is not all inclusive and as additional design information is developed it will be distributed for inclusion in this manual.

BASIC METRIC

Base Units

There are seven metric base units of measurement, six of which are used in design and construction. (The seventh, mole, is the amount of molecular substance and is used in physics.)

Quantity	Unit	Symbol
length	meter	m
mass∗	kilogram	kg
time	second	s
electric current	ampere	A
temperature	kelvin	K
luminous intensity	candela	cd

∗ “Weight” in common practice often is used to mean “mass.”

Celsius temperature (°C) is more commonly used than kelvin (K), but both have the same temperature gradients. Celsius temperature is simply 273.15 degrees warmer than kelvin, which begins at absolute zero. For instance, water freezes at 273.15 K and at 0 °C; it boils at 373.15 K and at 100 °C. To move between Celsius and kelvin, add or subtract 273.15.

Decimal Prefixes

Only two decimal prefixes are commonly used with the base units in design and construction.

Prefix	Symbol	Order of Magnitude	Expression
kilo	k	10^{3}	1000 (one thousand)
milli	m	10^{-3}	0.001 (one thousand)

The prefixes mega (M) for one million (10^{6}), giga (G) for one billion (10^{9}), micro (μ) for one millionth (10^{-6}), and nano (n) for one billionth (10^{-9}) are used in some engineering calculations.

Plane and Solid Angles

The radian (rad) and steradian (sr) denote plane and solid angles. They are used in lighting work and in various engineering calculations. In surveying, the units degree (°), minute ('), and second ('') continue in use.

Derived Units

Fifteen derived units with special names are used in engineering calculations:

Quantity	Name	Symbol	Expression
frequency	hertz	Hz	$Hz = s^{-1}$
force	newton	N	$N = kgm/s^2$
pressure, stress	pascal	Pa	$Pa = N/m^2$
energy, work,quantitiy of heat	joule	J	J = Nm
power, radiant flux	watt	W	W = J/s
electric charge, quantity	coulonmb	C	C = As
electric potential	volt	V	V= W/A or J/C
capacitance	farad	F	F = C/V
electric resistance	ohm	Ω	Ω = V/A
electric conductance	siemens	S	$S = A/V$ or Ω^{-1}
magnetic flux	weber	Wb	Wb = Vs
magnetic flux density	tesla	T	$T = Wb/m^2$
inductance	henry	H	H = Wb/A
luminous flux	lumen	lm	lm = cdsr
illunimance	lux	lx	$lx = lm/m^2$

Liter, Hectare, and Metric Ton

The liter (L) is the measurement for liquid volume. The hectare (ha) is a metric measurement used in surveying. The metric ton (t) is used to denote large loads such as those used in excavating.

Pronunciation

candela	Accent the second syllable, can-dell-ah.
hectare	Accent the first syllable: heck-tare. 'Me second syllable rhymes with care.
joule	Rhymes with pool.
kilometer	Accent the first syllable: kill-o-meter.
pascal	Rhymes with rascal.
siemens	Sounds like seamen's.

Rules for Writing Metric Symbols and Names

- Print unit symbols in upright type and in lower case except for liter (L) or unless the unit name is derived from a proper name.
- Print unit names in lower case, even those derived from a proper name.
- Print decimal prefixes in lower case for magnitudes 10^3 and lower (that is, k, m, μ, and n) print the prefixes in upper case for magnitudes 10^6 and higher (that is, M and G).
- Leave a space between a numeral and a symbol (write 45 kg or 37° C, not 45 kg or 37°C or 37° C).
- Do not use a degree mark (') with Kelvin temperature (write K, not °K).
- Do not leave a space a unit symbol and its decimal prefix (write kg, not k g.
- Do not use the plural of unit symbols (write 45 kg, not 45 kgs), but do use the plural of written unit names (several kilograms).
- For technical writing, use symbols in conjunction with numerals (the area is 10 m^2); write out unit names if numerals are not used (carpet is measured in square meters) Numerals may be combined with written unit names in nontechnical writing (10 meters).
- Indicate the product of two or more units in symbolic form by using a dot positioned above the line ($kgms^{-2}$).
- Do not mix names and symbols (write Nm or Newton meter, not or Newton).
- Do not use a period after a symbol (write " 12 g", not " 12 g.") except when it occurs at the end of a sentence.

Decimal prefixes to the tertiary power of 10 are preferred. The prefixes deci (d) for one tenth (10^{-1}), centi (c) for one hundredth (10^{-2}), deca (da) for ten (10^1), and hecto (h) for one hundred (10^2) have limited application in construction.

Rules for Writing Numbers

- Always use decimals, not fractions (write 0.75 g not ¾g).

- Use a zero before the decimal marker for values less than one (write 0.45 g, not .45 g).

Conversion and Rounding

- When converting numbers from inch-pounds to metric, round the metric value to the same number of digits as there were in the inch-pound number (11 miles at 1. 609 km/mi equals 17.699 km, which rounds to 18 km).

- Convert mixed inch-pound units (feet and inches, pounds and ounces) to the smaller inch-pound unit before converting to metric and rounding (10 feet, 3 inches = 123 inches; 123 inches x 25.4 mm = 3124.2 mm; round to 3124 mm).

- In a “soft”conversion, an inch-pound measurement is mathematically converted to its exact (or nearly exact) metric equivalent. With “hard” conversion, a new rounded, rationalized metric number is created that is convenient to work with and remember.

LENGTH, AREA, AND VOLUME

One metric unit is used to measure length, area, and volume in most design and construction work:

- meter (m).

Rules for Linear Measurement (Length)

- Use only the meter and millimeter in building design and construction.
- Use the kilometer for long distances and the micrometer for precision measurements.
- Avoid use of the centimeter.
- For survey measurement, use the meter and the kilometer.

Rules for Area

- The square meter is preferred.
- Very large areas may be expressed in square kilometers and very small areas, in millimeters.
- Use the hectare (10 000 square meters) for land and water measurement only. Avoid use of the square centimeter.
- Linear dimensions such as 40 x 90 mm may be used; if so, indicate width first and second.

Rules for Volume and Fluid Capacity

- Cubic meter is preferred for volumes in construction and for large storage tanks-

Use liter (L) and milliliter (ml) for fluid capacity (liquid volume). One liter is 1/1000 of a cubic meter or 1000 cubic centimeters.

Since a cubic meter equals one billion cubic millimeters, the cubic decimeter and cubic centimeter may be used in limited applications, since they are multiples of 1000 in volume measurement.

CONVERSION FACTORS

Quantity	From Inch-Pound Units	To Metric Units	Multiply by
Length	mile	km	1.609 344
	yard	m	0.914 4
	foot	m	0.304 8
	foot	mm	304.8
	inch	mm	25.4
Area	square mile	km^2	2.590 00
	acre	m^2	4 046.856
		ha (10,000 m^2)	0.404 685 6
	square yard	m^2	0.836 127 36
	square foot	m^2	0.092 903 04
	square inch	mm^2	645.16
Volume	acre foot	m^3	1 233.49
	cubic yard	m^3	0.764 555
	cubic foot	m^3	0.028 316 8
	cubic foot	cm^3	28 316.85
	cubic foot	L (1000 cm^3)	28.316 85
	100 board feet	m^3	0.235 974
	gallon	L (1000 cm^3)	3.785 41
	quart	L (1000 cm^3)	0.946 353
	ounce	ml^3	29.573 5
	cubic inche	cm^3	16.387 064
	cubic inch	mm^3	16 387.064
Mass	pound	kg	0.453 592
	ounce	g	28.349 5
	short ton (2000 lbs.)	metric ton (1000 kg)	0.907 184
Velocity	foot/sec	m/sec	0.304 8
	mile/hour	km/h	1.609 344

NOTE: Underline denotes exact number.

1. **Tons per Cubic Yard to Metric Tons per Cubic Meter**

$$\frac{1\ \text{Ton}}{\text{C.Y.}} \times \frac{1\ \text{C.Y.}}{.764555\ m^3} \times \frac{.907184\ \text{metric ton}}{\text{Ton}} = 1.18655\ \frac{\text{metric tons}}{m^3}$$

$$\frac{1\ \text{Ton}}{\text{C.Y.}} = \frac{1.18655\ \text{metric tons}}{m^3}$$

Example: Convert $\frac{2\ \text{Tons}}{\text{C.Y.}}$ to $\frac{\text{metric tons}}{m^3}$

$$2 \times 1.18655\ \frac{\text{metric tons}}{m^3} = 2.373\ \frac{\text{metric tons}}{m^3}$$

* Should be rounded to 2.4 in most cases.

2. **Pounds per Cubic Foot to Kilograms per Cubic Meter**

$$\frac{1\ \text{Lb.}}{\text{C.F.}} \times \frac{1\ \text{C.F}}{0.0283168\ m^3} \times \frac{0.4353592\ \text{kg}}{\text{Lbs.}} = 16.0185\ \frac{\text{kg}}{m^3}$$

$$\frac{1\ \text{Lb.}}{\text{C.F.}} = 16.0185\ \frac{\text{kg}}{m^3}$$

Example: Convert $\frac{150\ \text{Lbs.}}{\text{C.F.}}$ to $\frac{\text{kg}}{m^3}$ or $\frac{\text{metric tons}}{m^3}$

$$150 \times {}^{*}16.0185\ \frac{\text{kg}}{m^3} = 2403\ \frac{\text{kg}}{m^3} \text{ or } 2.403\ \frac{\text{metric tons}}{m^3}$$

* Should be rounded to 16 in most cases.

Temperature

base unit = Celsius

To convert from Celsius to Fahrenheit and vice versa the following formulas are used:

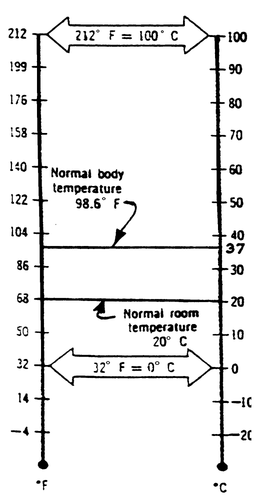
$$C = 5/9\,(F - 32)$$
$$F = 9/5C + 32$$

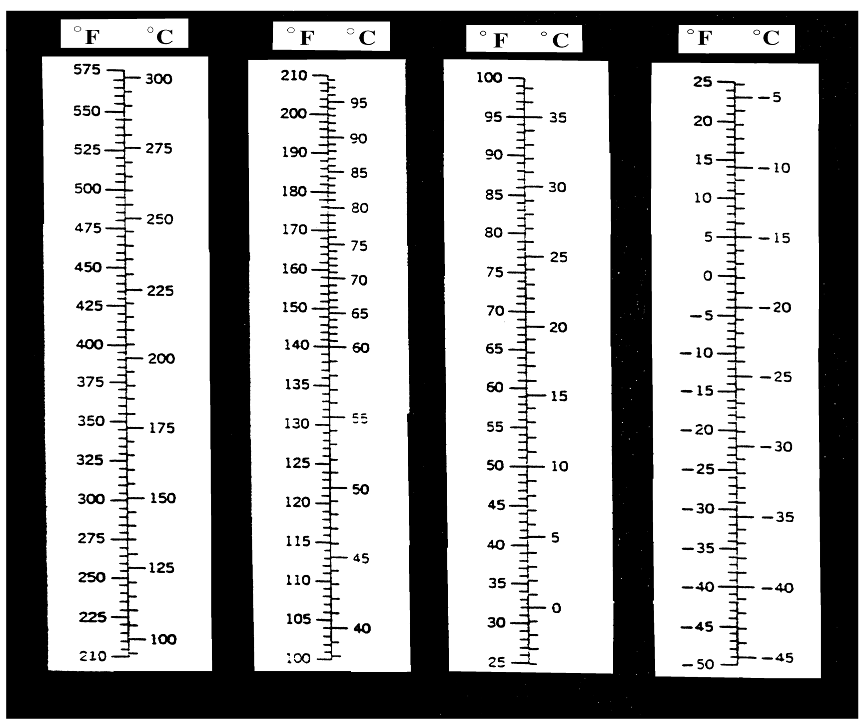
The ice point of water: $0^0C = 32^0F$
The steam point of water: $100^0C = 212^0F$
Body temperature: $37^0C = 98.6^0F$

Note:

The Kelvin scale is used by the scientific community. It is based on the temperature where water, ice, and water vapor exist in equilibrium. The ice point on the Kelvin scale is 273K and the steam point is 373 K. Hence one Celsius degree is equal to one Kelvin degree.

Temperature Conversion Chart
°F = Fahrenheit °C = Celsius





CONVERSION CHARTS

DECIMAL Inches	(in) Inches	(cm) Centimeters	(ft) Feet	(cm) Centimeters	(m) Meters	(km) Kilometer
0.0313	1/32	0.079	1	30.48	0.3048	0.000304
0.0625	1/16	0.159	2	40.96	0.4096	0.000409
0.0938	3/32	0.238	3	91.44	0.9144	0.000914
0.1250	1/8	0.318	4	121.92	1.2192	0.001219
0.1563	5/32	0.397	5	152.40	1.5240	0.001524
0.1875	3/16	0.476	6	182.88	1.8288	0.001828
0.2188	7/32	0.556	7	213.36	2.1336	0.002133
0.2500	1/4	0.635	8	243.84	2.4384	0.00.2438
0.2813	9/32	0.714	9	274.32	2.7432	0.002743
0.3125	5/16	0.794	10	304.80	3.0480	0.003048
0.3438	11/3	0.873	20	609.60	6.0960	0.00609b
0.3750	3/8	0.953	30	914.40	9.1440	0.009144
0.4063	13/32	1.032	40	1219.20	12.1920	0.012192
0.4375	7/16	1.111	50	1524.00	15.2400	0.01524
0.4688	15/32	1.191	60	1828.80	18.2880	0.018288
0.5000	1/2	1.270	70	2133.60	21.3360	0.021336
0.5313	17/32	1.349	80	2438.40	24.3840	0.024384
0.5625	9/16	1.429	90	2743.20	27.4320	0.027432
0.5938	19/32	1.508	100	3048.00	30.4800	0.03048
0.6250	5/8	1.588	200	6096.00	60.9600	0.06096
0.6563	21/32	1.667	300	9144.00	91.4400	0.09144
0.6875	11/16	1.746	400	12192.00	121.9200	0.12192
0.7188	23/32	1.826	500	15240.00	152.4000	0.1524
0.7500	3/4	1.905	600	18288.00	182.8800	0.18288
0.7813	25/32	1.984	700	21336.00	213.3600	0.21336
0.8125	13/16	2.064	800	24384.00	243.8400	0.24384
0.8438	17/32	2.143	900	27432.00	274.3200	0.27432
0.8750	718	2.223	1000	30480.00	304.8000	0.3048
0.9063	29/32	2.302	2000	60960.00	1609.6000	0.6096
0.9375	15/16	2.381	3000	91440.00	914.4000	0.9144
0.9688	31/32	2.461	4000	121920.00	1219.20	1.2192
1.0000	I	2.540	5000	152400.00	1524.00	1.524
2.0000	2	5.080	6000	182880.00	1828.80	1.8288
3.0000	3	7.620	7000	213360.00	2133.60	2.1336
4.0000	4	10.160	8000	243840.00	2438.40	2.4384
5.0000	5	12.700	9000	274320.00	2743.20	2.7432
6.0000	6	15.240	10000	304800.00	3048.00	3.048
7.0000	7	17.780				
8.0000	8	20.320				
9.0000	9	22.860				
10.0000	10	25.400				
11.0000	11	27.940				
12.0000	12	30.480				

VOLUME CONVERSION CHART

LITERS	GALIONS	QUARTS	LITERS
0.00	0.0	0.1	0.095
0.38	0.1	0.2	0.189
0.76	0.2	0.3	0.284
1.14	0.3	0.4.	0.379
1.51	0.4	0.5	0.473
1.89	0.5	0.6	0.568
2.27	0.6	0.7	0.662
2.65	0.7	0.8	0.757
3.03	0.8	0.9	0.352
3.41	0.9	1.0	0.94.6
3.79	1.0	2.0	1.893
7.57	2.0	3.0	2.839
11.36	3.0	4.0	3.785
15.14	4.0	5.0	4.732
18.93	5.0	6.0	5.678
22.71	6.0	7.0	6.624.
26.50	7.0	8.0	7.571
30.28	8.0	9.0	8.517
34.07	9.0	10.0	9.464
37.85	10.0	11.0	10.410
75.71	20.0	12.0	11.356
113.56	30.0	13.0	12.303
151.42	40.0	14.0	13.249
189.27	50.0	15.0	14.195
227.12	60.0	16.0	15.142
264.98	70.0	17.0	16.088
302.83	80.0	18.0	17.034
340.69	90.0	19.0	17.981
378.54	100.0	20.0	18.927
		21.0	19.873
		22.0	20.820
		23.0	21.766
		24.0	22.712
		25.0	23.659
		26.0	24.605
		27.0	25.552
		28.0	26.498
		29.0	27.444
		30.0	28.391

CIVIL AND STRUCTURAL ENGINEERING

The metric units used in civil and structural engineering are:

- meter (m)
- kilogram (kg)
- second (s)
- Newton (N)
- Pascal (pa)

Rules for Civil and Structural Engineering

- There are separate for mass and force.
- The kilogram (kg) is the base unit for mass, which is the unit quantity of MM independent of gravity.
- The Newton (N) is the derived unit for force (mass times acceleration, or kgm/s^2). It replaces the unit kilogram-force (kgf), which should not be used.
- Do not use the joule to designate torque, which is always designated Newton (Nm).
- The Pascal (Pa) is the unit for pressure and (Pa = N/m@. The term 'bar' is not a metric unit and should not be used.
- Structural calculations should be shown in MPa or kPa.
- Plane angles in surveying (cartography) will continue to be measured in degrees (either decimal degree or degrees, minutes, and rather dm the metric radian.

Civil and Structural Engineering Conversion Factors

Quantity	From Inch-Pound Units	To Metric Units	Multiply by
Mass	lb. kip (1000 lb.)	kg metric ton (1000 kg)	0.453 592 0.453 592
Mass/unit length	plf	kg/m	1.488 16
Mass/unit area	psf	kg/M^2	4.882 43
Mass density	pcf	kg/M^3	16.018 5
Force	lb. kip	N kN	4.448 22 4.448 22
Force/unit length	plf klf	N/m kN/m	14.593 9 14.593 9
Pressure, stress, modulus of elasticity	psf ksf psi ksi	Pa kPa kPa MPa	47.880 3 47.880 3 6.894 76 6.894 76
Bending moment,torque, moment of force	ft-lb. ft-kip	N-m kN-m	1.355 82 1.355 82
Moment of mass	lbrft	kam	0.138 255
Moment of inertia	$lbft^2$	kgm^2	0.042 140 1
Second moment of area	in	mm.	416.231
Section modulus	in^2	mm^3	<u>16387.064</u>

NOTE: Underline denotes exact number.

PLAN ELEMENT INFORMATION PRESENTLY RECOMMENDED BY VDOT

1 - Sheet size will remain the same.

2 - Stationing - 100 meter method

3 - Scales:

Plan Sheets
a) Rural - 1:500 (Plan sheet covers 400 m± along centerline)
b) Urban - 1:250 (Plan sheet covers 200 m± along centerline)

Profile Sheets
a) Rural - 1:500 Horizontal; 1:100 Vertical
b) Urban - 1:250 Horizontal; 1:50 Vertical

Cross-sections
a) Rural - 1:100 b) Urban - 1:50

4 - Pavement cross-slope - 2%
Shoulder cross-slope - 5% Paved; 6% Unpaved; 8% unpaved Local

5 - Degree of curve will no longer be used. All horizontal curve data will be based on the radius in meters.

6 - Degree-Minute-Second will be retained for angular measurement.

7 - Computed spiral transitions will be used for Rural curves with radius less than or equal to 850 meters.

8 - Cross-section/tick mark interval - 20 meters (Rural) 10 meters (Urban)

9 - All survey information will be expressed in meters except property data. Only property which is surveyed will be expressed in meters - other property data will be shown in units recorded in court records.

10 - Until computer software and other hydraulic design aids are available in metric, hydraulic design will continue to be performed in English units with descriptions of proposed structures converted to metric after computations are complete.

11 - Dual units will not be shown on plans with the probable exception of the R/W Data Sheet.

12 - Chords rather than concentric curves will be used to describe proposed R/W where a spiral curve transition is used.

13 - When converting meters to feet and extreme accuracy is needed, use the conversion factor for U.S. Survey Feet rather than the slightly different factor for the International Foot. The factors are as follows:

U.S. Survey Feet

For conversion of meters to U.S. Survey Feet, multiply the meters by 39.37 ÷ 12.0 which is 3.28083333333 to 12 significant figures.

International Feet

For conversion of meters to International Feet, multiply the meters by 100.0 ÷ 30.48 which is 3.28083989501 to 12 significant figures.

14 - The required accuracy for metric projects is as follows:

- All metric survey (horizontal and vertical) information will be obtained and processed to the nearest 0.001 m (1 mm).
- All proposed horizontal alignment information on the plans will be shown to the nearest 0.001 m.
- All proposed elevations will be shown to the nearest 0.005 m (5 mm).
- **Most horizontal offset and dimension information such as R/W monuments or locations of concrete items should be shown to the nearest meter or 0.1 meter.** An exception to this is R/W monuments located at curve points such as PC's, PT's, etc. where the station of the R/W monument will be shown to the same accuracy as the curve point (0.001 m).

15 - Descriptions for hydraulic items shall be shown in accordance with the following:

Pipe Culverts
1 - Length of culverts shall be shown to the nearest 0.5 m.
2 - Invert elevations shall be shown to the nearest 0.1 m. In some cases elevations may need to be shown to the nearest 0.01 m.

Storm Sewer
1 - Length of culverts shall be shown to the nearest 0.5 m.
2 - Invert elevations shall be shown to the nearest 0.01 m.
3 - Heights of manholes and drop inlets shall be shown to nearest 0.05 m.

Channels & Ditches
1 - Show width and depth to the nearest 0.1 m.

Pipe Cover
1 - Pipe Cover shall be shown to the nearest 0.1 m.

16 - 1 - The VDOT "Metric Logo" is to be shown on all sheets in the plan assembly. This logo appears on the base sheets in the CADD cells.

Note: This information is subject to change as further information is received.

DRAINAGE INFORMATION

In metric drainage design:

Discharge (Q) will be measured in cubic meters per second.
Velocity (V) will be measured in meters per second.
Small drainage areas will be measured in hectares.
Large drainage areas will be measured in square kilometers.

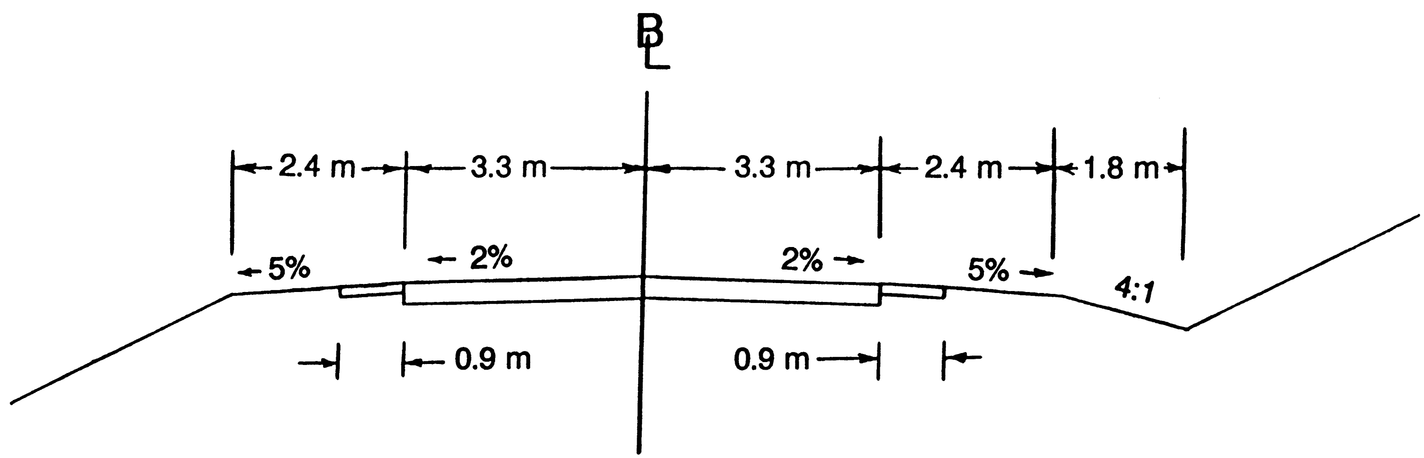
Millimeters (mm) will be used on Intensity-Duration-Frequency(IDF) Curves instead of inches.

PIPE CONVERSION CHART

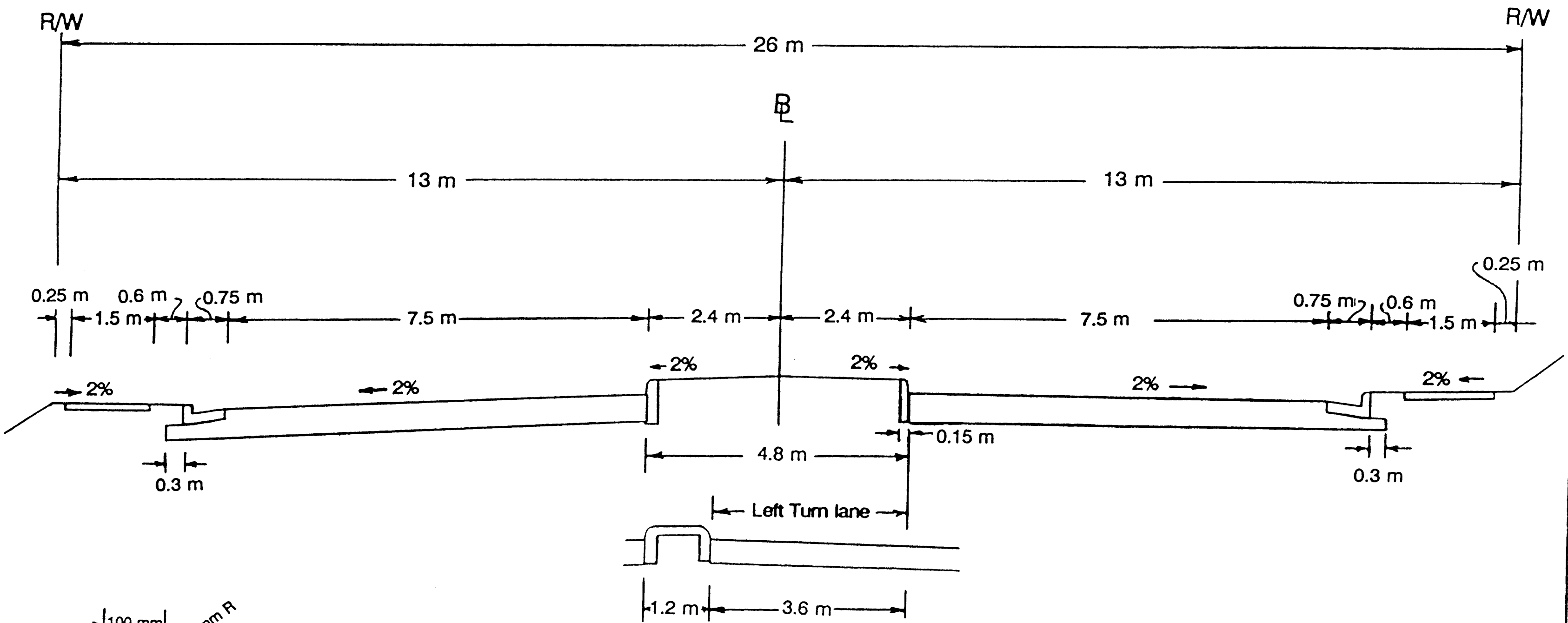
English Circular Size (in)	Metric Circular Size (mm)	Concrete Elliptical			
		Horizontal installation		Vertical Installation	
		Span X Rise (in X in)	Span X Rise (mm x mm)	Span X Rise (in x in)	Span X Rise (mm x mm)
6	150				
8	200				
12	300				
15	375				
18	450	23 X 14	575 X 365		
21	525				
24	600	30 x 19	770 X 490		
27	675	34 X 22	865 X 550		
30	750	38 X 24	960 X 610		
33	825	42 X 27	1055 X 670		
36	900	45 X 29	1150 X 730	29 X 45	730 X 1150
39		49 X 32	1250 X 795	32 X 49	795 X 1250
42	1050	53 X 34	1345 X 855	34 X 53	855 X 1345
48	1200	60 X 38	1535 X 975	38 X 60	975 X 1535
54	1350	68 X 43	1730 X 1095	43-X 68	1095 X 1730
60	1500	76 X 48	1920 X 1220	48 X 76	1220 X 1920
66	1650	83 X 53	2110 X 1340	53 X 83	1340 X 2110
72	1800	91 X 58	2305 X 1465	58 X 91	1465 X 2305
78	1950	98 X 63	2495 X 1585	63 X 98	1585 X 2495
84	2100	106 X 68	2690 X 1705	68 X 106	1705 X 2690
90	2250				
96	2400				
102	2550				
108	2700				
114	2850				
120	3000				

Drop Inlet Slot Lengths For	
English (ft)	Metric (m)
2.5	0.75
3	0.9
4	1.2
6	1.8
8	2.4
10	3.0
12	3.6
14	4.2
16	4.8
18	5.4
20	6.0

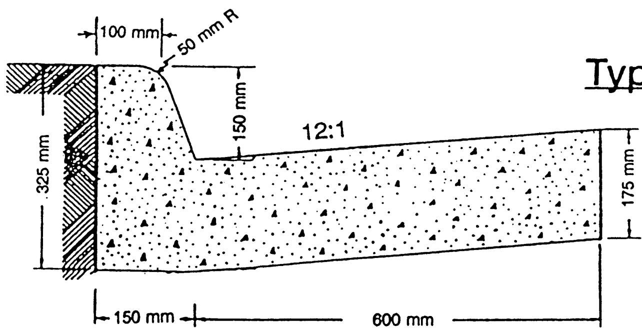
At the present time box culverts will be described using a soft conversion of Imperial dimensions. Size dimensions shall be shown to the nearest 0.01 m. Length of culverts shall be shown to the nearest 0.5 m. Example: 8 x 4 BCS-30 shall be described as 2.44 m x 1.22 m BCS-30.16



Typical Metric Rural Section



Typical Metric Urban Section



Metric CG-6

SPIRAL CURVES

In order to approximate the path a vehicle makes when entering or leaving a circular horizontal curve, a spiral transition curve will be provided for horizontal curves with a radius less than or equal to 850 meters, except for interchange ramps and loops.

The spiral to be used is known as the Talbot Transition Spiral and has the following characteristics:

1. - The radius of the spiral at any point is inversely proportional to its length. The radius at the TS (beginning of the spiral) is infinite and at the SC (end of the spiral) is equal to the radius of the circular curve R.

   R radius of the circular curve
   r radius at the distance L_x from TS
   LS length of spiral

   $R \div r = L_x \div LS$

2. - The central angle of a spiral curve is exactly 1/2 of a circular curve with the same radius and length.

   DE = central angle of spiral

   $DE = (28.6479 \times LS) \div R$

3. - Spiral angles are directly proportional to the squares of their lengths from the TS.

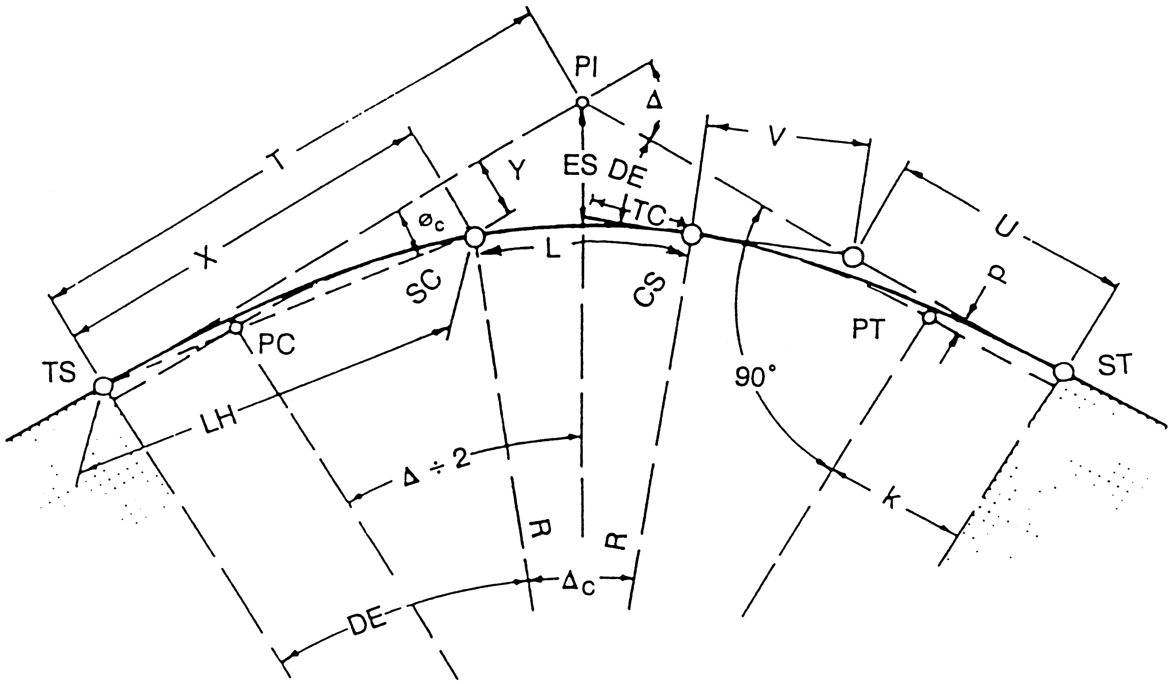
   Δ_L central angle for spiral for a length

   L_x from TS

   $\Delta_L = (L_x \div LS)^2 \times DE$

Formulas for computing spiral curve information is shown on the following two pages.

TRANSITION (SPIRAL) CURVES



LS =	Length of Spiral	V =	Short Tangent
L =	Length of Circular Curve	X =	Tangent Distance for SC
R =	Radius of Circular Curve	Y =	Tangent Offset of the SC
TC =	Tangent of Circular Curve	k =	Simple Curve Coordinate(Abscissa)
T =	Tangent Distance	P =	Simple Curve Coordinate(Ordinate)
Δ =	Deflection Angle Between the Tangents	$\varnothing_C$ =	Deflection Angle of SpiralCurve
DE =	Spiral Angle	TS =	Tangent to Spiral
Δ_C =	Central Angle Between the SC and CS	SC =	Spiral to Circular Curve
ES =	External Distance	CS =	Circular Curve to Spiral
LH =	Long Chord	ST =	Spiral to Tangent
U =	Long Tangent		

SPIRAL CURVE FORMULAS

DE = $(28.6479 \times LS) \div R$

Z = $0.01745 \times DE$

X = $LS \times [1 - (Z^2 \div 10) + (Z^4 \div 216)]$

Y = $LS \times [(Z \div 3) - (Z^3 \div 42) + (Z^5 \div 1320)]$

L = $(R \times \Delta_C) \div 57.2958$

TC = $R \times [\text{Tan}(\Delta_C \div 2)]$

Δ_C = $\Delta - (2 \times DE)$

p = $Y - [R \times (1 - \text{Cos } DE)]$

k = $X - [R \times (\text{Sin } DE)]$

TO CALCULATE T AND ES OF A SIMPLE CURVE WITH EQUAL SPIRALS

T = $[(R + p) \times \text{Tan}(\Delta \div 2)] + k$

ES = $[(R + p) \times \text{Exsec}(\Delta \div 2)] + p$

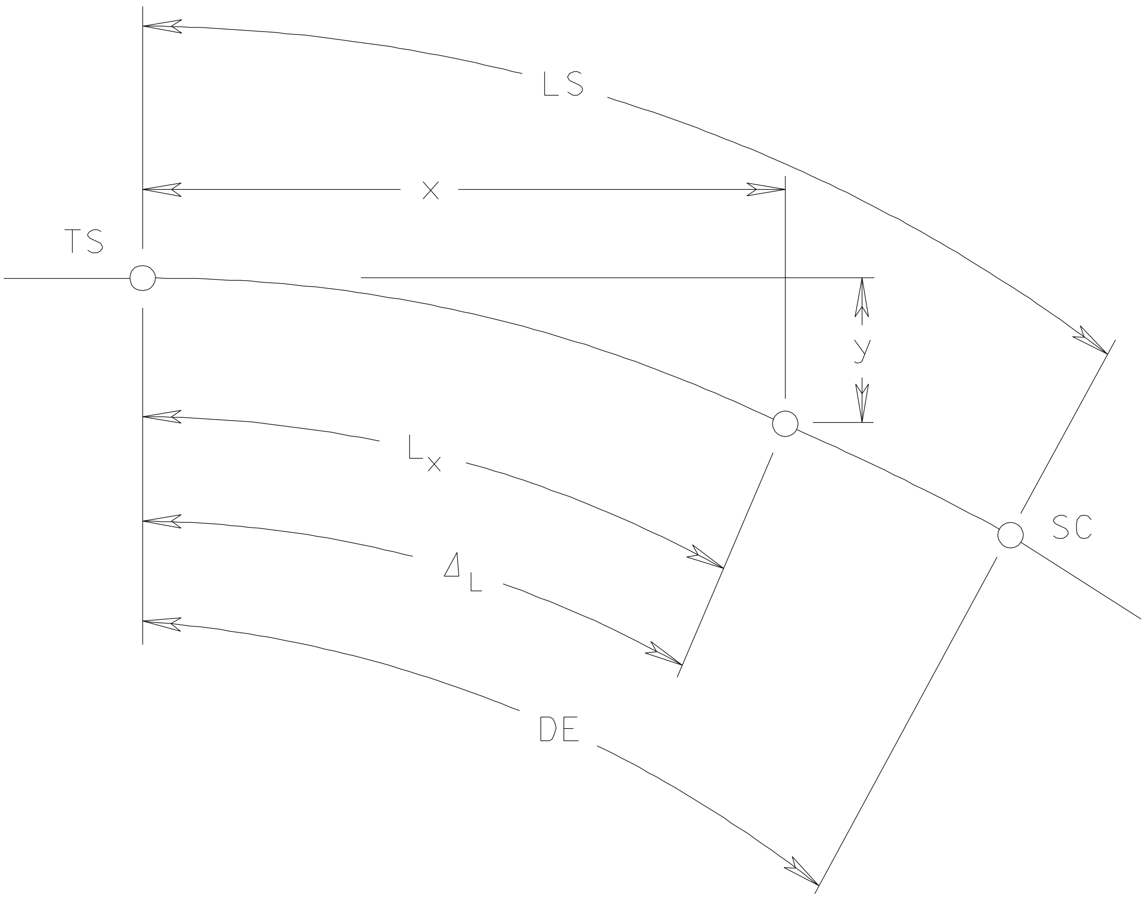
ES = $[(R + p) \div \text{Cos}(\Delta \div 2)] - R$

TO CALCULATE THE TANGENT DISTANCES OF A SIMPLE CURVE
WITH UNEQUAL SPIRALS

Ti_{in} = $[(R + P)_2 \div \text{Sin } \Delta] - [(R + p)_1 \times \text{Cot}\Delta] + k_1$

T_{out} $[(R + p)_1 \div \text{Sin } \Delta] - [(R + p)_2 \times \text{Cot } \Delta l + k$

**TO FIND COORDINATES OF ANY POINT ON THE SPIRAL
A DISTANCE L_X FROM THE TS**



$$DE = (28.6479 \times LS) \div R = (90 \times LS) \div (\pi \times R)$$

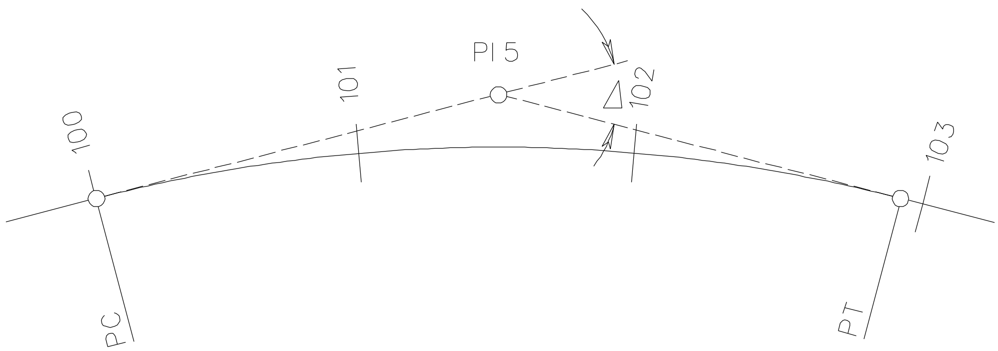
$$\Delta_L = (L_X \div LS)^2 \times DE$$

$$Z_L = 0.01745 \times \Delta_L$$

$$x = L_x \times [1 - (Z_L^2 \div 10) + (Z_L^4 \div 216)]$$

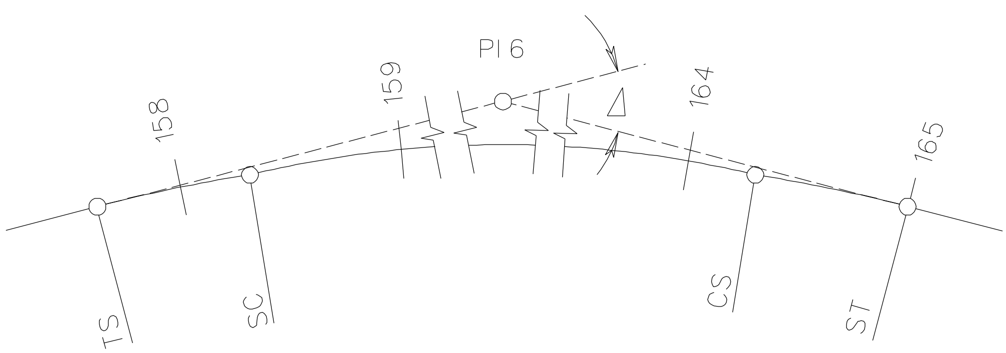
$$y = L_x \times [(Z_L \div 3) - (Z_L^3 \div 42) + (Z_L^5 \div 1320)]$$

HORIZONTAL CURVES EXAMPLE
(Not to Scale)



Lane A
PI NO. 5
DELTA = 18° 26' 40" RT
T = 146.126
L = 289.725
R = 900.000
PC = 100+00.000
PI = 101+46.126
PT = 102+89.725
V = 90 km/h
E = 3.1%

URBAN - NO SPIRAL TRANSITION



Lane A
PI NO. 6
DELTA = 54° 49' 28" RT
T = 395.663
L = 604.807
R = 700.000
LSIN = 65.000
LSOUT = 65.000
TS = 157+64.500
SC = 158+29.500
PI = 161+60.163
CS = 164+34.307
ST = 164+99.307
V = 100 km/h
E = 6.3%

RURAL - WITH SPIRAL TRANSITION

AASHTO METRIC CRITERIA AND CONTROLS

The information contained in this appendix which was developed by a task force of the AASHTO highway Subcommittee on Geometric Design was approved by AASHTO as of November 17, 1992. However, this information may be subject to change as needs dictate. The recommendations from the Highway Subcommittee on Traffic Engineering discussed in this appendix have not yet received AASHTO approval and may also be subject to change. Therefore, the reader should always consult the most recent version of AASHTO policy on these subjects.

INTRODUCTION

The AASHTO Metric Task Force requested that each AASHTO Highway Subcommittee and task force develop a position and recommendations addressing metrication items in their areas of responsibility. The metric task forces of the Subcommittees on Geometric Design and Traffic Engineering submitted initial recommendations to the AASHTO Standing Committee on Highways. The Geometric Design recommendations have been approved by AASHTO. The Traffic Engineering recommendations have not, as of this date, been submitted for formal AASHTO approval.

The Geometric Design Task Force identified nine areas critical to basic geometric design. These values can be used by all States as interim design criteria until a complete version of *A Policy on Geometric Design of Highways and Streets* (the Green Book) is published in 1995. The Subcommittee on Traffic identified two critical areas. These values can be used as interim criteria until the metric version of the MUTCD is published in 1995. Results from both Task Forces are contained in this appendix.

The AASHTO committees and task forces are attempting to address the metrication impacts in all areas of highway transportation. It is possible that different task forces will adopt different criteria for the same items. It may be that as the highway industry begins to use the criteria, they may be revised. Thus, some metric criteria in this appendix may require change at a later date. The reader is advised to seek the most recent version of AASHTO policy on these issues.

SELECTED METRIC VALUES FOR GEOMETRIC DESIGN

The AASHTO Task Force on Geometric Design has reviewed *"A Policy on Geometric Design of Highways and Streets"* (Green Book) and identified the following geometric design elements as critical elements in metric conversion. These values have been adopted by AASHTO.

I. Speed

Design Speed km/h		Running Speed km/h
30	(18.64 mph)	30
40	(24.85 mph)	40
50	(31.07 mph)	47
60	(37.28 mph)	55
70	(43.50 mph)	63
80	(49.71 mph)	70
90	(55.92 mph)	77
100	(62.14 mph)	85
110	(68.35 mph)	91
120	(74.56 mph)	98

II. Lane Width

2.7 m	(8.86 ft.)	(1.56% less than 9' lane)
3.0 m	(9.84 ft.)	(1.60% less than 10' lane)
3.3 m	(10.83 ft.)	(1.55% less than 11' lane)
3.6 m	(11.81 ft.)	(1.58% less than 12' lane)

The values established by the Task Force are slightly narrower (ranging from 4 to 10 percent less) than the corresponding Canadian values. Canadian values are set in 0.25 increments. This level of preciseness (hundredths of a meter) appears to be excessive for this element. The Task Force believes that preciseness to 1/10 m is acceptable and has set values accordingly.

The Task Force believes that the values established are in line with recent research regarding lane widths and safety benefits (TRB 214 and the NCHRP 15-12 (the latter currently in progress). Furthermore, construction practices and the pavement striping process generally yield lane widths somewhat less than 9, 10, 11, or 12 feet. The metric values established are typically 1.5 percent below the corresponding English values now specified. This difference is considered negligible with respect to safety benefits. Some capacity reduction may theoretically result, but in practical terms, such a reduction is not expected to be significant.

III. Shoulders

0.6 m	(1.97 ft.)
1.2 m	(3.94 ft.)
1.8 m	(5.91 ft.)
2.4 m	(7.87 ft.)
3.0 m	(9.84 ft.)

The Task Force, in establishing shoulder width values, attempted to recognize the value of a shoulder width less than 1 m and provide flexibility for that instance.

IV. Vertical Clearance

3.8 m	(12.47 ft.)
4.3 m	(14.11 ft.)
4.9 m	(16.08 ft.)

The 4.9 m value is seen to be the critical value since the federal legislation required Interstate design to have 16 feet vertical clearance. In view of the fact that the Interstate, now virtually complete, is based on this minimum clearance, the metric value should provide this clearance as a minimum. The 4.9 m value accomplishes this objective. Other vertical clearance values are not deemed to be as rigid as this value.

V. Clear Zone

With two exceptions, the *Green Book* refers to *Roadside Design Guide* for clear zone values. The two critical values are the clear zone for urban conditions and locals and collectors. The Task Force has set the following:

Urban Conditions	-	0.5 m (1.64 ft.)
Locals/Collectors	-	3.0 m minimum (9.84 ft.)

VI. Curbs

A. Curb Heights

1. Mountable Curb	100 mm max (4")
2. Barrier Curb	150 mm max (6")

B. The definition of high speed/low speed has an impact on where curb is used.

Low speed - 60 km/h or less design speed
High speed - 80 km/h or more design speed

VII. Sight Distance

Stopping Sight Distance

Eye Height	1070 mm (3.51 ft.)
Object Height	150 mm (5.91 in.)
Headlight Height	610 mm (2 ft.)

Passing Sight Distance

Eye Height	1070 mm (3.51 ft.)
Object Height	1300 mm (4.27 ft.)

Provided are Tables III-1, III-6, III-40 and III-42, which were prepared to show various suggested sight distance values.

VIII. Horizontal Curvature

Radius definition should be used in lieu of degree of curve. Radius should be expressed in multiples of 5 m increments.

IX. Structures

Long Bridges will be those over 60 m in length.

Design Speed (km/h)	Assumed Speed for Condition (km/h)	Brake Reaction		Coefficient of Friction f	Braking Distance on Level (m)	Stopping Sight Distance (m)
		Time (sec)	Distance (m)			
30	30-30	2.5	20.8-20.8	0.40	8.8-8.8	29.6-29.6
40	40-40	2.5	27.8-27.8	0.38	16.6-16.6	44.4-44.4
50	47-50	2.5	32.6-34.7	0.35	24.8-28.1	57.4-62.8
60	55-60	2.5	38.2-41.7	0.33	36.1-42.9	74.3-84.6
70	63-70	2.5	43.7-48.6	0.31	50.4-62.2	94.1-110.8
80	70-80	2.5	48.6-55.5	0.30	64.2-83.9	112.8-139.4
90	77-90	2.5	53.5-62.5	0.30	77.7-106.2	131.2-168.7
100	85-100	2.5	59.0-69.4	0.29	98.0-135.6	157.0-205.0
110	91-110	2.5	63.2-76.4	0.28	116.3-170.0	179.5-246.4
120	98-120	2.5	68.0-83.3	0.28	134.9-202.3	202.9-285.6

Table III-1. Stopping Sight Distance (wet pavements).

Design Speed (km/h)	Maximum e	Maximum f	Total (e+ f)	Calculated Radius (meters)	Rounded Radius (meters)
30	0.04	0.17	0.21	33.7	35
40	0.04	0.17	0.21	60.0	60
50	0.04	0.16	0.20	98.4	100
60	0.04	0.15	0.19	149.2	150
70	0.04	0.14	0.18	214.3	215
80	0.04	0.14	0.18	280.0	280
90	0.04	0.13	0.17	375.2	375
100	0.04	0.12	0.16	492.1	490
110	0.04	0.11	0.15	635.2	635
120	0.04	0.09	0.13	872.2	870
30	0.06	0.17	0.23	30.8	30
40	0.06	0.17	0.23	54.8	55
50	0.06	0.16	0.22	89.5	90
60	0.06	0.15	0.21	135.0	135
70	0.06	0.14	0.20	192.9	195
80	0.06	0.14	0.20	252.0	250
90	0.06	0.13	0.19	335.7	335
100	0.06	0.12	0.18	437.4	435
110	0.06	0.11	0.17	560.4	560
120	0.06	0.09	0.15	755.9	755
30	0.08	0.17	0.25	28.3	30
40	0.08	0.17	0.25	50.4	50
50	0.08	0.16	0.24	82.0	80
60	0.08	0.15	0.23	123.2	125
70	0.08	0.14	0.22	175.4	175
80	0.08	0.14	0.22	229.1	230
90	0.08	0.13	0.21	303.7	305
100	0.08	0.12	0.20	393.7	395
110	0.08	0.11	0.19	501.5	500
120	0.08	0.09	0.17	667.0	665
30	0.10	0.17	0.27	26.2	25
40	0.10	0.17	0.27	46.7	45
50	0.10	0.16	0.26	75.7	75
60	0.10	0.15	0.25	113.4	115
70	0.10	0.14	0.24	160.8	160
80	0.10	0.14	0.24	210.0	210
90	0.10	0.13	0.23	277.3	275
100	0.10	0.12	0.22	357.9	360
110	0.10	0.11	0.21	453.7	455
120	0.10	0.09	0.19	596.8	595
30	0.12	0.17	0.29	24.4	25
40	0.12	0.17	0.29	43.4	45
50	0.12	0.16	0.28	70.3	70
60	0.12	0.15	0.27	105.0	105
70	0.12	0.14	0.26	148.4	150
80	0.12	0.14	0.26	193.8	195
90	0.12	0.13	0.25	255.1	255
100	0.12	0.12	0.24	328.1	330
110	0.12	0.11	0.23	414.2	415
120	0.12	0.09	0.21	539.9	540

Note: In recognition of safety considerations, use of e = 0.04 should be limited to urban conditions.

Table III-6. Minimum radius determined for limiting values of e and f, rural highways and high-speed urban streets.

Design Speed (km/h)	Assumed Speed for condition (km/h)	Coefficient of Friction f	Stopping Sight Distance (m)	Rate of Vertical Curvature, K [length (m) per percent of A]	
				Computed	Rounded for Design
30	30-30	0.40	29.6-29.6	2.17-2.17	3-3
40	40-40	0.38	44.4-44.4	4.88-4.88	5-5
50	47-50	0.35	57.4-62.8	8.16-9.76	9-10
60	55-60	0.33	74.3-84.6	13.66-17.72	14-18
70	63-70	0.31	94.1-110.8	21.92-30.39	22-31
80	70-80	0.30	112.8-139.4	31.49-48.10	32-49
90	77-90	0.30	131.2-168.7	42.61-70.44	43-71
100	85-100	0.29	157.0-205.0	61.01-104.02	62-105
110	91-110	0.28	179.5-246.4	79.75-150.28	80-151
120	98-120	0.28	202.9-285.6	101.90-201.90	102-202

Using computed values of stopping sight distance.

Table III-35. Design controls for crest vertical curves based on stopping sight distance.

Design Speed (km/h)	Assumed Speed for condition (km/h)	Coefficient of Friction f	Stopping Sight Distance (m)	Rate of Vertical Curvature, K [length (m) per percent of A]	
				Computed	Rounded for Design
30	30-30	0.40	29.6-29.6	3.88-3.88	4-4
40	40-40	0.38	44.4-44.4	7.11-7.11	8-8
50	47-50	0.35	57.4-62.8	10.20-11.54	11-12
60	55-60	0.33	74.3-84.6	14.45-17-12	15-18
70	63-70	0.31	94.1-110.8	19.62-24.08	20-25
80	70-80	0.30	112.8-139.4	24.62-31.86	25-32
90	77-90	0.30	131.2-168.7	29.62-39.95	30-40
100	85-100	0.29	157.0-205.0	36.71-50.06	37-51
110	91-110	0.28	179.5-246.4	42.95-61.68	43-62
120	98-120	0.28	202.9-285.6	49.47-72.72	50-73

Using computed values of stopping sight distance.

Table III-37. Design controls for sag vertical curves based on stopping sight distance.

SELECTED METRIC VALUES FOR TRAFFIC

Most of the applications of interest to the Highway Subcommittee on Traffic Engineering are conversions associated with measurements found in the *Manual on Uniform Traffic Control Devices* (MUTCD). These values include sign sizes, pavement marking widths, traffic signal lens size, etc. The following excerpt is taken from the Traffic Engineering Subcommittee work. Please note that the values are recommendations only. They have not yet been formally adopted by AASHTO.

CONVERSION VALUES:

This list will not be exhaustive, but the principles set out should allow conversion of any value encountered.

I. Signs	Dimension in inches x 25 = millimeters	
	Typical metric sign sizes	300 mm
		450 mm
		600 mm
		750 mm
		900 mm
		1050 mm
		1200 mm
		1350 mm
		1500 mm

The difference between a hard conversion (1 inch = 25 mm) and a soft conversion (1 inch = 25.4 mm) is only 1.6 percent.

The Federal Highway Administration (FHWA) maintains the following two documents as supplements to the *Manual on Uniform Traffic Control Devices*:

1. Standard Alphabets for Highway Signs and Pavement Markings.

2. Standard Highway Signs.

Both documents are in English units, but will be converted to metric units for distribution at the time of release of the metric version of the MUTCD-1995. In general, the horizontal dimensions in these manuals will be soft converted and rounded to the nearest whole millimeter. These dimensions include stroke width, spacing, etc. Vertical dimensions will be hard converted by multiplying the letter height in inches by 25. For example, an 8-inch high letter would be identified as a 200 mm letter in the metric alphabet manual.

II. Pavement Markings

Width in inches x 25 = millimeters
Typical metric widths 100 mm
150 mm
200 mm

Pavement marking lengths in feet x 0.30 = meters.
Typical hop-skip line of 10 feet and 30 feet = 3 m and 9 m.
Again, the difference between a hard and soft conversion is 1.6 percent.

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CURVE BOX INSTRUCTIONS

1) Using Metric Curve Box:

Metric curves in box are labeled with their actual radius in mm.

Scale Ratio X Radius desired (in meters) X 1000 (to convert m to mm) = radius (from box)

Example: Plan Scale 1 : 500, Shown as: $\frac{1}{500}$
Radius desired = 750 m

$\frac{1}{500}$ X 750 m X 1000 mm/m = 1500 mm radius (from box)

2) Using Customary Curve Boxes:

Customary curves in box are labeled with their actual radius (inches) or degree of curvature (based on a scale of 1" : 100').

Radius Curves:

Scale Ratio X Radius desired (in meters) ÷ 0.3048 m/ft. X 12 in./ft. = radius (from box)

Example: Plan Scale = 1 : 500, Shown as: $\frac{1}{500}$
Radius desired = 750 m

$\frac{1}{500}$ X 750 m ¸ .3048 m/ft. X 12 in./ft. = 59.06 inches or 60 inches (from box)

Degree Curves:

Example: Plan Scale = 1 : 500, Shown as: $\frac{1}{500}$
Radius desired = 750 m

Compute radius (in inches) as shown above.

Radius (inches) = 59.06 inches

Radius (inches) X Scale (ft./in.) = radius (feet)

59.06 inches X 100 = 5906 ft.

Degree = $\frac{5729.578}{5906}$ = $.9701^0$ or $1^0$00'00"

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DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

REVISED	FHWA REGION	STATE	FEDERAL AID PROJECT	STATE ROUTE	STATE PROJECT	SHEET NO.
	3	VA.		132	0132 - 122 - V04, RW - 201 C - 501	2

TYPICAL SECTION

RTE 132 (SAMPLE DR.)

NOTES:

When liquid asphalt material is used as a curing material for a hydraulic cement or lime stabilized course, it shall be CMS-2, CMS-2h or CRS-2 and applied at the rate of 0.75 ^{2} L/m . Where necessary for maintenance of construction traffic or public traffic, cover material Fine Aggregate Minimum Grading "B" shall be applied at the rate of 6.8^{2}kg/m . All costs for such curing materials and any cover materials shall be included in price bid for the hydraulic cement or lime stabilized course.

The surface course shall be placed in two applications, as directed by the Engineer. This will facilitate in the maintaining of two way traffic on the new lane and associated pavement striping.

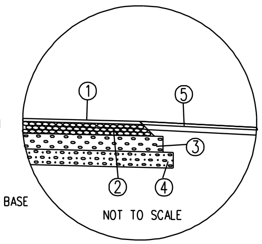
In cases of temporary connections, tie-ins, and short sections of heavy traffic, Stabilized Subgrade is to be replaced by 150 mm of aggregate base material Type 1, No. 21B. The substitution should only be used where absolutely necessary.

Prime shoulders with Liquid Asphalt Material RC-70 @ 0.95 L/m^2 and cover with Aggr. No. 78 @ 11 kg/m^2. Double seal with Liquid Asphalt Material RC-250 @ 0.75 L/m^2 and cover with Aggregate No. 78 (Crushed stone) @ 11 Kg/m^2.

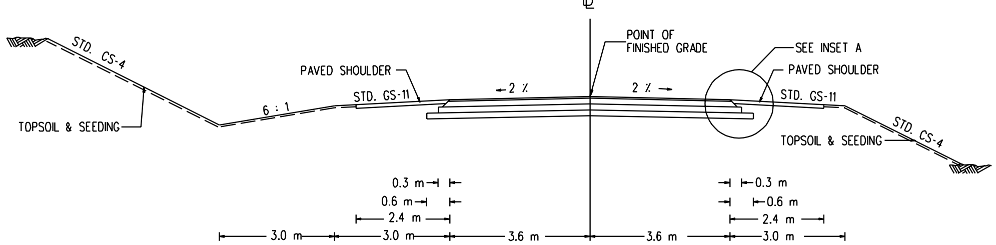
The existing roadway that is to be utilized should be overlayed with 75 kg/m^2 of asphalt concrete Type SM-2C and the shoulders should be built up with aggregate base material Type 1, No. 21B. The width and depth would be variable depending upon the existing circumstances.

INSET A

1. ASPHALT CONCRETE SURFACE COURSE TYPE SM-2C @ 90 kg/m^2
2. 100 mm ASPHALT CONCRETE BASE COURSE BM-2
3. 150 mm AGGREGATE BASE MATERIAL TYPE 1 NO. 21B (For Subbase)
4. HYDRAULIC CEMENT STABILIZED SUBGRADE (10% BY VOLUME, 150 mm DEPTH)
5. STABILIZED SHOULDER, 150 mm AGGREGATE BASE MATERIAL TYPE 1, NO. 21B WITH PRIME AND DOUBLE SEAL SURFACE TREATMENT



MAINLINE ℄



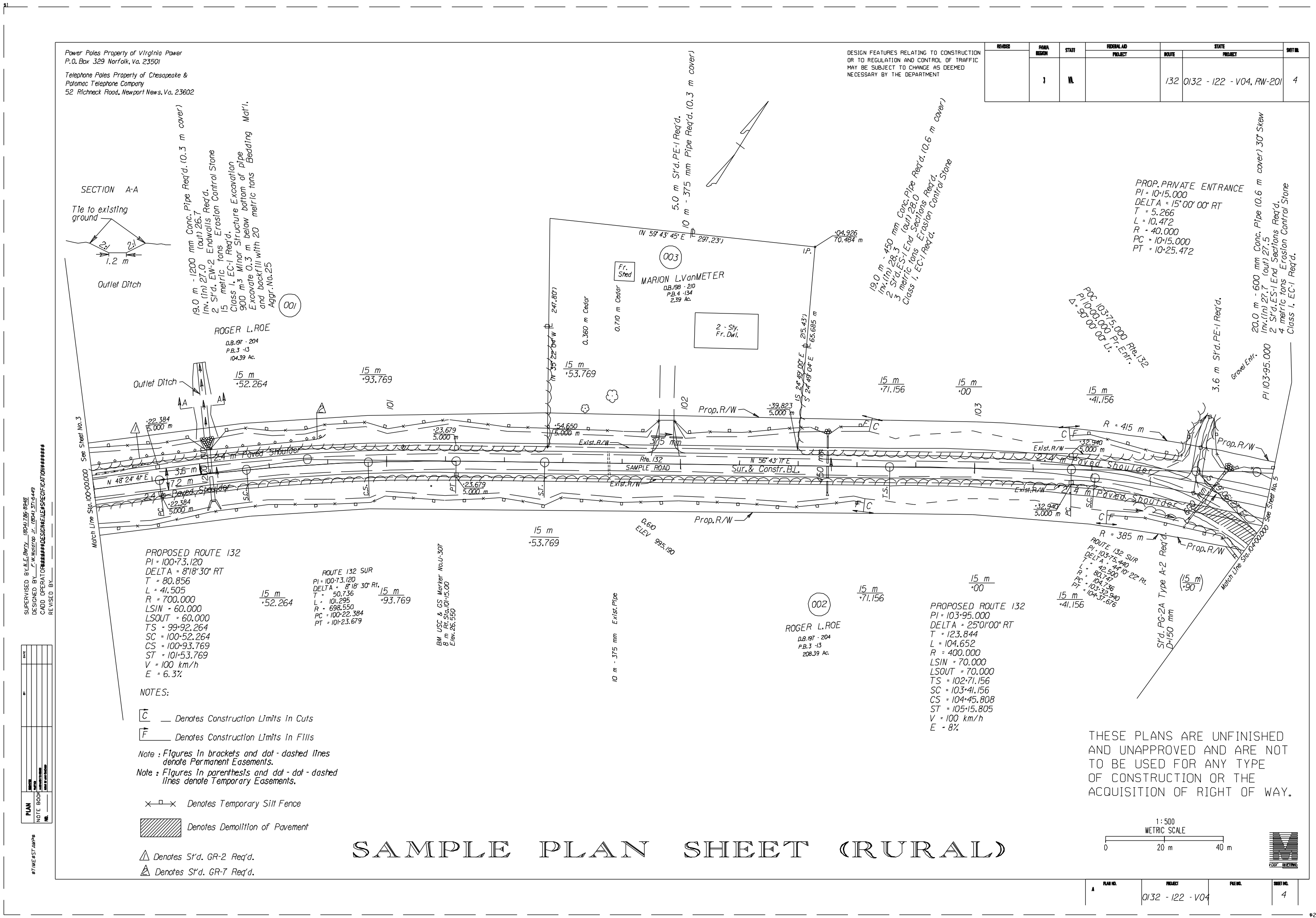
STATION	TO	STATION
100+00.00	~	104+50.00

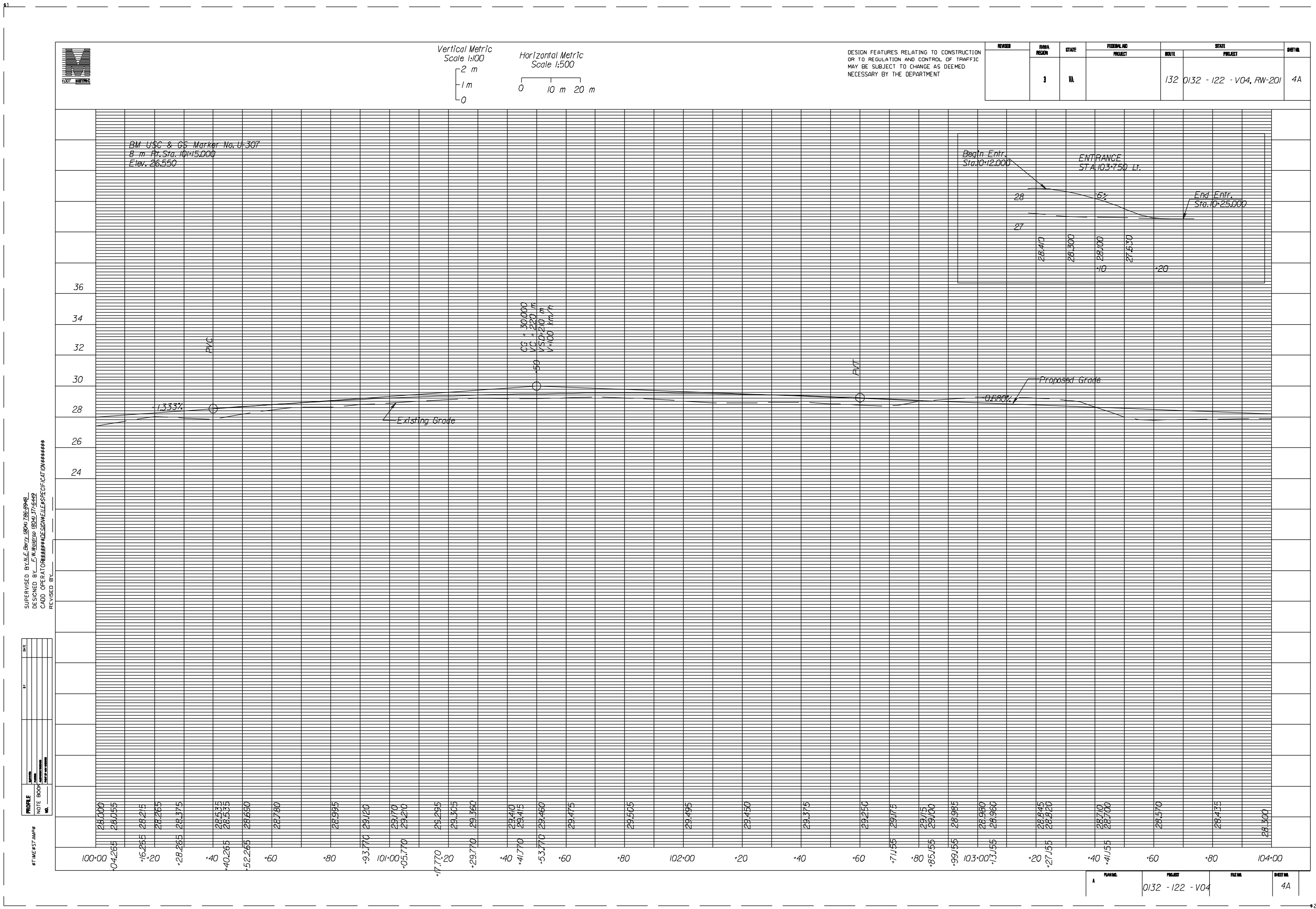
SAMPLE TYPICAL SECTION SHEET

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

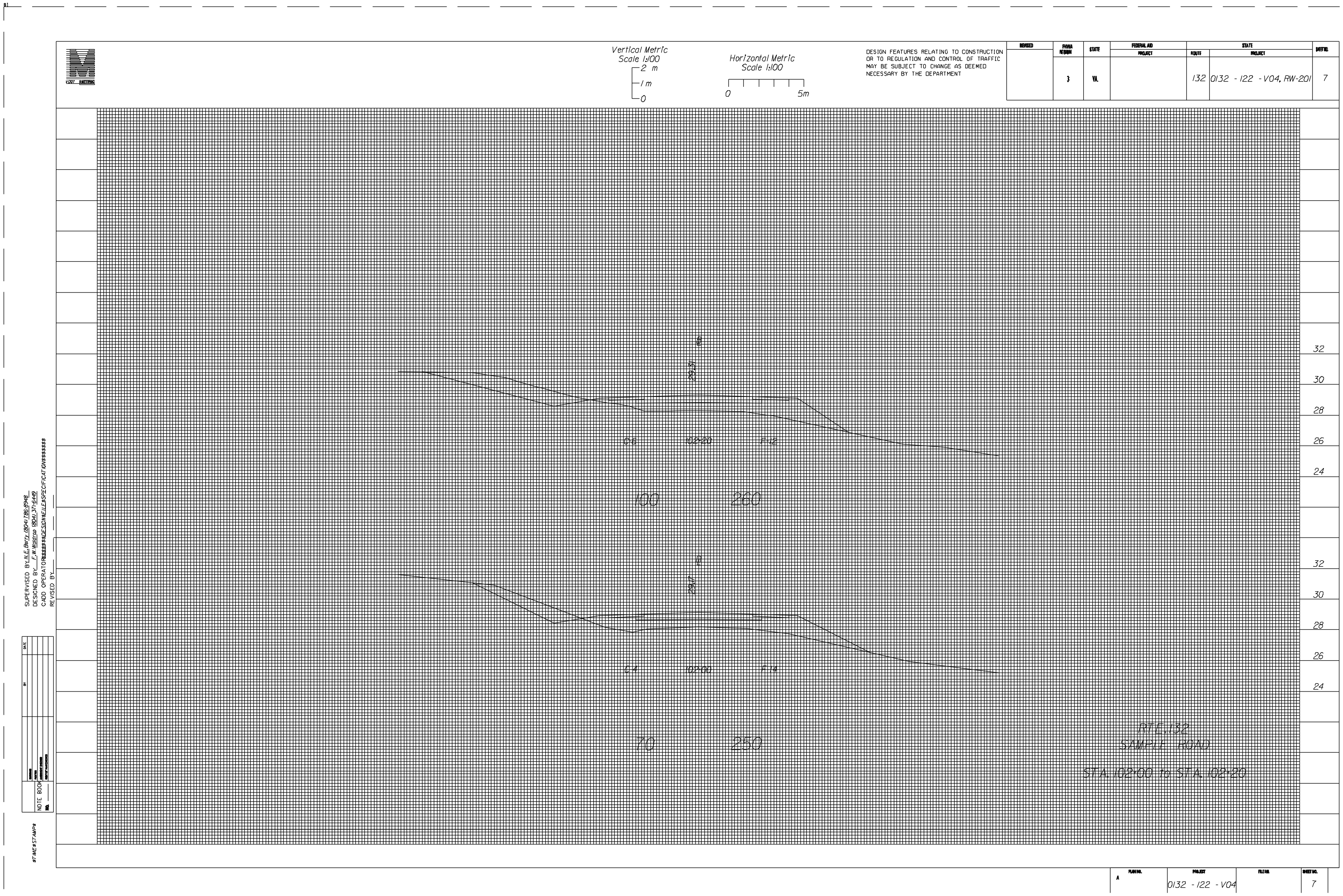
SUPERVISED BY N. E. Berry (804) 786-8948
DESIGNED BY F. W. Waldrop (804) 786-6449
CADD OPERATOR
REVISED BY

PLAN NO.	PROJECT	FILE NO.	SHEET NO.
A	0132 - 122 - V04		2


Power Poles Property of Virginia Power
P.O. Box 329 Norfolk, Va. 23501
Telephone Poles Property of Chesapeake & Potomac Telephone Company
52 Richneck Road, Newport News, Va. 23602
DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT
132 0132 - 122 - V04, RW-201 4
SECTION A-A
Tie to existing ground
1.2 m
Outlet Ditch
19.0 m - 1200 mm Conc. Pipe Req'd. (0.3 m cover)
2 Std. EW-2 Endwalls Req'd.
Class I, EC-I Req'd.
Aggr. No.25
001
ROGER L.ROE
5.0 m Std. PE-1 Req'd.
10 m - 375 mm Pipe Req'd. (0.3 m cover)
003
MARION L.VanMETER
Fr. Shed
2 - Sty. Fr. Dwl.
0.360 m Cedar
0.710 m Cedar
19.0 m - 450 mm Conc. Pipe Req'd. (0.6 m cover)
Class I, EC-I Req'd.
PROP. PRIVATE ENTRANCE
PI = 10+15.000
DELTA = 15°00' 00" RT
T = 5.266
L = 10.472
R = 40.000
PC = 10+15.000
PT = 10+25.472
3.6 m Std. PE-1 Req'd.
Gravel Entr.
PI 103+95.000
20.0 m - 600 mm Conc. Pipe (0.6 m cover) 30° Skew
2 Std. ES-1 End Sections Req'd.
Class I, EC-I Req'd.
Outlet Ditch
Prop. R/W
Exist. R/W
2.4 m Paved Shoulder
3.6 m
Rte. 132
SAMPLE ROAD
Sur. & Constr. Bl.
R = 415 m
R = 385 m
Match Line Sta. 100+00.000 See Sheet No. 3
Match Line Sta. 104+00.000 See Sheet No. 5
PROPOSED ROUTE 132
PI = 100+73.120
DELTA = 8°18'30" RT
T = 80.856
L = 41.505
R = 700.000
LSIN = 60.000
LSOUT = 60.000
TS = 99+92.264
SC = 100+52.264
CS = 100+93.769
ST = 101+53.769
V = 100 km/h
E = 6.3%
ROUTE 132 SUR
PI = 100+73.120
DELTA = 8°18' 30" Rt.
T = 50.736
L = 101.295
R = 698.550
PC = 100+22.384
PT = 101+23.679
10 m - 375 mm Exist. Pipe
002
ROGER L.ROE
PROPOSED ROUTE 132
PI = 103+95.000
DELTA = 25°01'00" RT
T = 123.844
L = 104.652
R = 400.000
LSIN = 70.000
LSOUT = 70.000
TS = 102+71.156
SC = 103+41.156
CS = 104+45.808
ST = 105+15.805
V = 100 km/h
E = 8%
Std. PG-2A Type A-2 Req'd.
NOTES:
C Denotes Construction Limits in Cuts
F Denotes Construction Limits in Fills
Note : Figures in brackets and dot - dashed lines denote Permanent Easements.
Note : Figures in parenthesis and dot - dot - dashed lines denote Temporary Easements.
Denotes Temporary Silt Fence
Denotes Demolition of Pavement
Denotes Std. GR-2 Req'd.
Denotes Std. GR-7 Req'd.
THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.
SAMPLE PLAN SHEET (RURAL)
1:500
METRIC SCALE
0
20 m
40 m
0132 - 122 - V04
4



SAMPLE PROFILE SHEET (RURAL)



SAMPLE CROSS SECTION SHEET (RURAL)

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

REVISED	PHASE/REGION	STATE	FEDERAL AID PROJECT	ROUTE	STATE PROJECT	SHEET NO.
	3	VA.			U000-155-103, RW-201 C-501	2X

DRAINAGE SUMMARY

SHEET NUMBER	STRUCTURE NUMBER	COVER	CONCRETE PIPE 300 mm	CONCRETE PIPE 375 mm	CONCRETE PIPE 450 mm	CONCRETE PIPE 525 mm	CONCRETE PIPE 600 mm	CONCRETE PIPE 750 mm	CONCRETE PIPE 900 mm	CONCRETE PIPE 1200 mm	CONCRETE PIPE 1650 mm	C. M. PIPE 300 mm	C. M. PIPE 375 mm	C. M. PIPE 450 mm	C. M. PIPE 600 mm	C. M. PIPE 1350 mm	ELLIP. CONC. PIPE 1535 mm X 975 mm	ELLIP. CONC. PIPE 1730 mm X 1095 mm	⊗ MINOR STRUCTURE EXCAV.	⊗ BEDDING MATERIAL AGGREGATE NUMBER 25 OR 26	END-SECTIONS STANDARD ES-1, 375 mm	END-SECTIONS STANDARD ES-1, 450 mm	END-SECTIONS STANDARD ES-1, 900 mm	HEIGHT OF INLETS
		m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m³	Metric Ton	Ea.	Ea.	Ea.	m
7	7-1	0.6									63.5								261					
7	7-2 to 7-8	0.7		10.0																				1.3
7	7-3 to 7-12	0.5		17.5																				1.2
7	7-5	0.3							1.0														1	
7	7-6 to 7-9	1.0							45.0															1.7
7	7-7 to 7-14	0.6		31.0																				0.9
7	7-8																							1.2
7	7-10 to 7-14	0.3		12.5																				0.8
7	7-11 to 7-12	0.9			16.5																			1.3
7	7-12 to 7-4	1.0			5.0																	1		1.5
7	7-13 to 7-10	0.4		2.5																	1			
7	7-14 to 7-11	0.5		14.0																				1.1
7	7-8 to 7-11	0.6		19.5																				
7	7-15																							
SHEET 2V SUBTOTAL				195.0	140.5	123.0	28.0			292.5		10.5	12.0	7.0		5.0	47.5	59.0	2457	252	1			
SHEET 2W SUBTOTAL			8.5	394.0	88.5		42.5	35.0	323.5	49.0					1.0		10.0		360	150				
SHEET 2X SUBTOTAL				107.0	21.5				46.0		63.5								261		1	1	1	
TOTAL			8.5	696.0	250.5	123.0	70.5	35.0	369.5	341.5	63.5	10.5	12.0	7.0	1.0	5.0	57.5	59.0	3078	372	2	1	1	—

DROP INLETS

STRUCTURE NUMBER	DI-1	DI-2A	SPECIAL DESIGN DROP INLET	DI-3A	DI-2B L = 2.4 m	DI-2B L = 3.6 m	DI-2B L = 4.8 m	DI-2D	DI-2E L = 2.4 m	DI-2E L = 3.0 m	DI-2E L = 6.0 m	DI-3B L = 1.2 m	DI-3B L = 1.8 m	DI-3B L = 2.4 m	DI-3B L = 3.0 m	DI-3B L = 3.6 m	DI-3B L = 4.2 m	DI-3B L = 6.0 m	DI-3C L = 1.8 m	DI-3C L = 6.0 m	DI-4A	DI-4AA	DI-4B L = 1.8 m	DI-4B L = 4.8 m	DI-4BB L = 1.8 m	DI-4D	DI-4E L = 2.4 m	DI-7	DI-7A	DI-12 L = 1.2 m
	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.	Ea.
7-1																														
7-2 to 7-8															1															
7-3 to 7-12															1															
7-5																														
7-6 to 7-9																								1						
7-7 to 7-14	1																													
7-8				1																										
7-10 to 7-14														1																
7-11 to 7-12				1																										
7-12 to 7-4																			1											
7-13 to 7-10																														
7-14 to 7-11													1																	
7-8 to 7-11																														
7-15																														
SHEET 2V SUBTOTAL	3		1	3			1		1				1		2	1		3			1	1	2		1	2	2	5		1
SHEET 2W SUBTOTAL	3	1		1	1	1		1		1	2	1	2	4	3	2	1			1	1	1	1					2	1	
SHEET 2X SUBTOTAL	1			2									1	1	2				1					1						
TOTAL	7	1	1	6	1	1	1	1	1	1	2	1	4	5	7	3	1	3	1	1	2	2	3	1	1	2	2	7	1	1

STRUCTURE NUMBER	DI-12C L = 1.2 m	DI-12C L = 1.8 m	MODIFIED DI-2E L = 2.4 m	MODIFIED DI-3B L = 2.4 m	MODIFIED DI-3C L = 1.8 m	MANHOLE MH-1 OR 2	FRAME & COVER MH-1	SPECIAL DESIGN TRENCH INLET L = 6.0 m	SPECIAL DESIGN TRENCH INLET L = 12.0 m	EROSION CONTROL STONE CLASS I, EC-1	EROSION CONTROL STONE CLASS II, EC-1	REMARKS
	Ea.	Ea.	Ea.	Ea.	Ea.	m	Ea.	Ea.	Ea.	Metric Ton	Metric Ton	
7-1										61	54	(2) EW-7S ENDWALLS-2:1 SLOPES
7-2 to 7-8												STANDARD IS-1 REQUIRED
7-3 to 7-12												
7-5												
7-6 to 7-9												IS-1, 900 mm X 1650 mm WYE JOINT
7-7 to 7-14												
7-8												STANDARD IS-1 REQUIRED
7-10 to 7-14												STANDARD IS-1 REQUIRED
7-11 to 7-12												STANDARD IS-1 REQUIRED
7-12 to 7-4										2		STANDARD IS-1 REQUIRED
7-13 to 7-10												
7-14 to 7-11												STANDARD IS-1 REQUIRED
7-8 to 7-11												
7-15												SEE S. M. W. SUMMARY
SHEET 2V SUBTOTAL	1	1	1	1	1	12.2	7	1	1			
SHEET 2W SUBTOTAL						6.1	3	1				
SHEET 2X SUBTOTAL										63	54	
TOTAL	1	1	1	1	1	18.3	10	2	1	63	54	

STORMWATER MANAGEMENT CONTROL SUMMARY

LOCATION SHEET NO.	LOCATION STRUCT. NO.	HEIGHT OF COVER	600 mm CONC. PIPE	SWM BASIN EXCAVATION	SWM DRAINAGE STRUCTURE SWM-1	SWM RISER PIPE 1200 mm	SWM DAM CONC. CLASS A-3 MISC.	SWM DAM REINF. STEEL	REMARKS
		m	m	m³	m	m	m³	kg	
7									
	7-15	0.5	5.0	——	——	1.0	——	——	SEE SHEET 20 FOR ADDITIONAL DETAILS

129.5 m TRIPLE 1.52 m X 1.22 m BOX CULVERT SUMMARY STRUCTURE 3-23 & 3-14, 3B-2 PROJECT U000-155-103

SEE SHEETS 12 (1 THRU 4) FOR DETAILS

CONCRETE CLASS 30 BOX CULVERT	⊗	m³	471.5
EPOXY COATED REINFORCING STEEL	⊗	kg	45,414
MINOR STRUCTURE EXCAVATION BOX CULVERT	⊗	m³	1,055
BEDDING MATERIAL AGGREGATE NUMBER 25 OR 26	⊗	Metric Tons	303

UNDERDRAIN SUMMARY

STATION	CD-1	CD-2
	m	m
11-40 LT.	12	
11-55 RT.	17	
18-45 LT.	12	
19-40 RT.	12	
26-30	24	
40-30		16
TOTAL	77	16

⊗ Denotes Items to be paid for on basis Of Plan Quantities In accordance with current Road And Bridge Specifications.

SAMPLE

SURVEYED BY
SUPERVISED BY
DESIGNED BY
CADD OPERATOR
REVISED BY

U000-155-103

PLAN NO.	PROJECT	PLAN NO.	SHEET NO.

DGN $DGNLEV $REF001 $LEV001 $REF002 $LEV002 $REF003 $LEV003 $REF004 $LEV004 $REF005 $LEV005 $REF006 $LEV006

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

REVISED	FHWA REGION	STATE	FEDERAL AID PROJECT	ROUTE	STATE PROJECT	SHEET NO.
	3	VA.			U000-155-103, RW-201 C-501	2Z

Depot Street Extension

PAVEMENT SUMMARY

LOCATION	STATION FROM	STATION TO	PAVEMENT AREA (m²)	SURFACE: ASPHALT CONCRETE TYPE SM-2B @ 100 kg PER m² (METRIC TONS)	BASE: ASPHALT CONCRETE TYPE BM-2, 100 mm DEPTH (METRIC TONS)	BASE: ASPHALT CONCRETE TYPE BM-2, 150 mm DEPTH (METRIC TONS)	BASE: ASPHALT CONCRETE TYPE BM-2, 250 mm DEPTH (METRIC TONS)	SUBBASE: AGGREGATE BASE MATERIAL TYPE I NO. 21B, 100 mm DEPTH (METRIC TONS)	SUBBASE: AGGREGATE BASE MATERIAL TYPE I NO. 21B, 200 mm DEPTH (METRIC TONS)	RESURFACING: ASPHALT CONCRETE TYPE SM-2B @ 100 kg/m² VARIABLE DEPTH (METRIC TONS)
DEPOT ST. EXT.	10+45.760	21+39.543	17,308	1,549			10,892	5,795		
FRANKLIN STREET	17+05.000	20+99.725	1,068	95			671	473		
RADFORD STREET	57+11.000	60+88.657	6,231	538			3,921	2,064		
COLLEGE ST. (N)	10+24.000	10+39.541	233	21	58				124	
BETTY DRIVE	10+34.100	10+54.196	217	19	54				115	
NEW STREET	10+24.280	10+50.410	233	21	58				122	
SHELTMAN ST.	10+23.480	10+49.855	245	22	62				128	
SULLIVAN ST.	10+04.220	10+49.573	398	35	100				209	
BRACKENS ST.	10+18.360	10+51.786	293	26	73				100	
SCHOOL ENTR.	10+50.930	10+90.272	414	37	104				217	
TAYLOR ST.	10+30.240	10+81.987	394	35	99				126	
JAMES ST.	10+26.410	10+48.848	232	22	60				110	
LEE-HY COURT DR.	10+22.960	10+42.482	198	18	50				168	
HILLCREST DR.	10+02.990	10+40.181	316	28	80				282	
COLLEGE ST. (S) LT. SIDE	37+00.000	37+55.956	516	46	130				269	
CHERRY LANE	9+90.330	10+54.248	495	44	124				282	
COLLEGE ST. (S) RT. SIDE	39+63.390	40+09.300	504	45	126				206	
MAIN ST. (RTE 8)			1,570							141
ENTRANCES										
MAINTENANCE of TRAFFIC						476				
PARKING LOT (023)										
TOTAL				2,631	1,178	476	15,484	8,332	2,458	141

LOCATION	ENTRANCES: ASPHALT CONCRETE SURFACE COURSE TYPE SM-2B @ 120 kg/m² (METRIC TONS)	ENTRANCES: ASPHALT CONCRETE SURFACE COURSE TYPE SM-2B @ 100 kg/m² (METRIC TONS)	ENTRANCES: ASPHALT CONCRETE BASE COURSE TYPE BM-2 100 mm DEPTH (METRIC TONS)	ENTRANCES: ⊗ CONCRETE ENTRANCE PAVEMENT 175 mm (m²)	ENTRANCES: AGGREGATE BASE MATERIAL TYPE I NO. 21B, 100 mm DEPTH (METRIC TONS)	ENTRANCES: AGGREGATE BASE MATERIAL TYPE I NO. 21B, 150 mm DEPTH (METRIC TONS)	ENTRANCES: CRUSHER RUN AGGREGATE NUMBER 25 OR 26 (METRIC TONS)	ENTRANCES: CRUSHER RUN AGGREGATE NUMBER 25 OR 26 PE-I (METRIC TONS)	ENTRANCES: ⊗ FLEXIBLE PAVEMENT PLANING (m²)
DEPOT ST. EXT.									
FRANKLIN STREET									
RADFORD STREET									
COLLEGE ST. (N)									
BETTY DRIVE									
NEW STREET									
SHELTMAN ST.									
SULLIVAN ST.									
BRACKENS ST.									
SCHOOL ENTR.									
TAYLOR ST.									
JAMES ST.									
LEE-HY COURT DR.									
HILLCREST DR.									
COLLEGE ST. (S) LT. SIDE									
CHERRY LANE									
COLLEGE ST. (S) RT. SIDE									
MAIN ST. (RTE 8)									1,087
ENTRANCES	20	104	297	226	21	489	205	39	
MAINTENANCE of TRAFFIC							907		
PARKING LOT (023)		83	61			337			
TOTAL	20	187	358	226	21	826	1,112	39	1,087

SAMPLE

INCIDENTAL SUMMARY

SHEET NO.	⊗ COMBINATION CURB & GUTTER CG-6 STANDARD (m)	⊗ CG-6 RADIAL (m)	⊗ CURB CG-2 STANDARD (m)	⊗ CURB CG-2 RADIAL (m)	⊗ ENTRANCE GUTTER CG-9D (m²)	⊗ ENTRANCE GUTTER CG-13 (m²)	⊗ EXPOSED AGGREGATE SIDEWALK 100 mm (m²)	⊗ EXPOSED AGGREGATE SIDEWALK 175 mm (m²)	⊗ HYDRAULIC CEMENT CONCRETE SIDEWALK 100 mm (m²)	GUARDRAIL GR-2 STANDARD (m)	GUARDRAIL GR-2 RADIAL (m)	GUARDRAIL TERMINAL GR-7 (EA.)	FIXED OBJECT ATTACHMENT GR-FOA-2 TYPE I (EA.)	R/W MONUMENT RM-1 (EA.)	⊗ DEMOLITION OF PAVEMENT (m²)	⊗ OBSCURING ROADWAY (UNIT)	REMOVE EXISTING BOX CULVERT: 65 m OF 1.52 m X 1.68 m BOX CULVERT STATION 11+50 Rt. — DEPOT ST. (L.S.)	STRUCTURE TO BE REMOVED: EXISTING BRIDGE STATION 19+20 Lt. — FRANKLIN (L.S.)	STRUCTURE TO BE REMOVED: EXISTING BRIDGE STATION 20+30 Lt. — FRANKLIN (L.S.)
3	200	99		11	63	181	13	33	542					18	2,419		1		
3B	79	4			130		3		141					2				1	1
3C	97				53		8		175					2					
4	262	58	2	19	250	186	9	51	756					12	2,903				
5	354	98	15		108	93	13	14	1,024					12	3,523				
6	462	172	3		130		29		1,341					27	4,076	1			
6B	203	16	6		36		5		449					7	1,562				
6C	53	50		3	95	122	8	28	187					13	1,759				
7	287	36			17		7		678	88	9	2	1	17	408	1			
8	86	57					7		191					10	418				
IG, IH															1,263				
TOTAL	2,083	590	26	33	882	582	102	126	5,484	88	9	2	1	120	18,331	2	L.S.	L.S.	L.S.

SHEET NO.	REMOVE EXISTING GUARDRAIL (m)	REMOVE EXISTING DROP INLET (EA.)	ADJUST EXISTING MANHOLE (EA.)	PIPE PLUGGING CONC. CLASS 20 MISC. (m³)	STEPS: CONCRETE CLASS 20 MISC. (m³)	STEPS: REINFORCING STEEL (kg)	HANDRAIL HR-1 (m)	⊗ CONC. RETAINING WALL: POROUS BACKFILL (m³)	⊗ CONC. RETAINING WALL: RETAINING WALL EXCAVATION (m³)	⊗ CONC. RETAINING WALL: BEDDING MAT'L. AGGREGATE NO. 25 OR 26 (METRIC TON)	⊗ CONC. RETAINING WALL: RETAINING WALL RW-3 (m³)	⊗ PAVED DITCH PG-2A (m²)	⊗ PAVED DITCH PG-5 (m²)	⊗ PAVED FLUME PG-4 (m²)	DRY RIP-RAP CLASS I 450 mm (METRIC TON)	FENCE: ⊗ FENCE FE-CL (m)	FENCE: CORNER BRACE UNIT FE-CL (EA.)	MOBILIZATION (L.S.)	CONSTRUCTION SURVEYING (L.S.)	⊗ DIRECTIONAL ISLAND CURB SI-3 (m)	CLEARING AND GRUBBING (L.S.)	FIELD OFFICE TYPE II (Mo.)	ALLAYING DUST (Hr.)	GROUP 2 CHANNELIZING DEVICES (DAY)	ELECTRONIC ARROW (Hr.)	FLAGGER SERVICE (Hr.)	WARNING LIGHT TYPE A (DAY)	TRAFFIC BARRIER SERVICE CONCRETE (m)
3	12	4		1.1																								
3B																												
3C																												
4				0.9	0.9		2					23																
5				0.4	0.5		2					31		3														
6					2.9	104	8	1	18	5	13																	
6B			1		1.0		4																					
6C				0.5	0.9		4						19															
7															58	91	4			37								
8					0.8	29	5																					
IG, IH																												100
TOTAL	12	4	1	2.9	7.0	133	25	1	18	5	13	54	19	3	58	91	4	L.S.	L.S.	37	L.S.	Mo.	1500	18,500	500	2,500	4,000	100

⊗ Denotes items to be paid for on basis of plan quantities in accordance with current Road & Bridge Specifications.

VDOT METRIC

SURVEYED BY ___ SUPERVISED BY ___ DESIGNED BY ___ CADD OPERATOR $$$$$$DESIGN$FILE$SPECIFICATION$$$$$$$ REVISED BY ___

$TIME$STAMP$

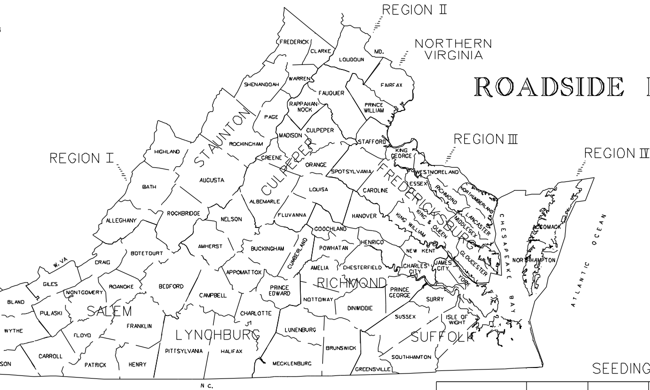
PLAN NO.	PROJECT	FILE NO.	SHEET NO.
	U000-155-103		2Z

REGION Ⅰ - Bristol, Salem, Staunton, Lynchburg, and Culpeper Districts minus Rappahannock and Fauquier Counties

REGION Ⅱ - Rappahannock, Fauquier and Loudoun Counties

REGION Ⅲ - Richmond, Fredericksburg and Northern Virginia Districts minus Loudoun County

REGION Ⅳ - Suffolk District

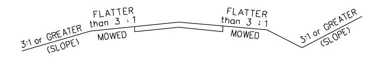


DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

REVISED	FHWA REGION	STATE	FEDERAL AID PROJECT	STATE ROUTE	STATE PROJECT	SHEET NO.
	3	VA.				

ROADSIDE DEVELOPMENT

SECTION OF SEED LOCATIONS



NOTES

Approximately ________ hectares will be disturbed on this project and will require the establishment of grasses and / or legumes.

☆ NOTES FOR FIELD USE ONLY

Supplemental seeding consists of overseeding or regular seeding as determined by the Engineer.

Overseeding rates shall be 50% of the seed mixture specified and fertilizer rates shall be 33% of the rates specified.

The Engineer will require the Contractor to perform supplemental seeding when less than 75 percent uniform stand of the permanent grass specified in the mixture is obtained. (Annual species such as, Rye and Millet are temporary varieties and require supplemental seeding.)

Tall and Fine Fescue shall not be used in Loudoun, Fauquier and Rappahannock Counties. (Mix 4 only) Orchard Grass mixture shall be used for these counties. Type Ⅱ mulch only.

NOTES APPLY TO SCHEDULE

Legume seed mixes (Crown Vetch and Sericea Lespedeza) and weeping Lovegrass shall not be used on shoulders and other locations flatter than 3:1 slope.

A temporary mix or erosion control mulch, as directed by the Engineer, is to be used only on areas that are to be regraded or later disturbed, if left dormant for more than 30 days, between March 1 and November 30.

Spring and Fall defined for the purpose of determining whether hulled or unhulled Bermuda and Sericea Lespedeza seed is required:

Spring - May 1 - Sept. 30
Fall - Oct. 1 - Apr. 30

Type Ⅰ mulch (Straw or Hay) to be used on newly seeded areas adjacent to all waterways, wetlands, swamps, or any area in which drainage flows toward areas under the jurisdiction of the environmental regulatory agencies.

Type Ⅰ mulch shall be applied at 4.5 metric tons per hectare to provide a minimum 90% coverage.

Type Ⅰ mulch shall be tacked with Fiber mulch at the rate of 840 kg per hectare.

Type Ⅱ mulch (Fiber mulch) may be substituted for Type Ⅰ mulch at the recommendation of the District Environmental Manager.

Type Ⅱ mulch shall be applied at a rate of 2000 kg (net dry weight) per hectare.

Erosion Control Mulch, as listed on the VDOT Approved Products List, shall be applied in accordance with the manufactures' recommendations.

Erosion control mulch shall provide 100% coverage of all denuded areas.

All topsoil is to be free of hard lumps, clods, rocks and foreign debris and is to be hand raked to tie into existing lawns.

All seed must be in conformance with VDOT seed specifications for Grasses & Legumes and be provided at the project site in bags not opened and labled for use on VDOT projects with a green tag certifying inspection by the Virginia Crop Improvement Association.

CORE MIX

MIX	MINIMUM kg/hectare	DESCRIPTION
1	115	100% CERTIFIED FINE FESCUE
2	115	100% CERTIFIED TALL FESCUE
3	60 60	50% CERTIFIED TALL FESCUE 50% CERTIFIED FINE FESCUE
4	60 60	50% ORCHARD GRASS 50% CERTIFIED KENTUCKY BLUEGRASS
5	60	100% BERMUDA GRASS
TEMPORARY		
3/1 – 5/16 and 8/16 – 3/1	60 60	50% CERTIFIED TALL FESCUE 50% WHEAT, BARLEY OR RYE
5/16 - 8/16	60 60	50% FOXTAIL MILLET 50% CERTIFIED TALL FESCUE

ADDITIVES

TYPE	MINIMUM kg/hectare	DESCRIPTION
A	2 10	100% LOVE GRASS OR 100% FOXTAIL MILLET
B	25	100% RYE GRAIN, WHEAT OR BARLEY
C	25	100% CROWN VETCH
D	25	100% SERICEA LESPEDEZA
E	10 10	100% FOXTAIL MILLET OR 100% ANNUAL RYEGRASS

SEEDING SCHEDULE

REGIONS	SLOPES SEED MIX WITH ADDITIVE	MOWED SEED MIX WITH ADDITIVE	SLOPES SEED MIX WITH ADDITIVE	MOWED SEED MIX WITH ADDITIVE	SLOPES SEED MIX WITH ADDITIVE	MOWED SEED MIX WITH ADDITIVE
Ⅰ	2, 3, 4 B, C, D	1, 2, 3, 4 B	2, 3, 4 A, C	1, 2, 3, 4 A, E	2, 3, 4 B, C, D	1, 2, 3, 4 B
Ⅱ	4 B, C	4 B	4 A, C	4 E	4 B, C	4 B
Ⅲ	2, 3 B, C	2, 3 B	2, 3 A, C, D	2, 3 E	2, 3 B, D	2, 3 B
Ⅳ	2, 5 B, C, D	2, 5 B	2, 5 A, C, D	2, 5 E	2, 5 B, C, D	2, 5 B

REGIONS	SPRING & FALL MONTH & DATE	SUMMER MONTH & DATE	LATE FALL & WINTER MONTH & DATE
Ⅰ	4/1 – 6/15 8/1 – 9/30	6/16 – 7/31	10/1 – 3/31
Ⅱ	3/1 – 5/15 8/1 – 9/30	5/16 – 7/31	10/1 – 2/29
Ⅲ, Ⅳ	3/1 – 4/30 8/1 – 10/31	5/1 – 7/31	11/1 – 2/29

MIX REQUIREMENTS THIS PROJECT

SEED MIXTURE RECOMMENDATIONS MAY AT TIMES DEVIATE FROM THE SEED MIXTURE GUIDELINES ON THE ROADSIDE DEVELOPMENT SHEET. RECOMMENDATIONS FOR THE APPLICATION OF SEED MIXTURES (CORE MIX AND ADDITIVES), FERTILIZER, LIME, ETC. ARE TO BE OBTAINED FROM THE DISTRICT ENVIRONMENTAL MANAGER ON FORM RD-100.

PROJECT NUMBERS						

EROSION & SEDIMENT CONTROL SUMMARY

PROJECT NUMBERS	SLOPE DRAINS	Erosion Control Stone EC-1 Class Ⅰ	DEWATERING BASIN	SILTATION CONTROL EXCAVATION	TEMPORARY FILTER BARRIER	FILTER CLOTH DRAIN FABRIC TYPE Ⅰ	CONSTR. ENTRANCE	TEMP. SILT FENCE	CHECK DAM TY. Ⅰ	CHECK DAM TY. Ⅱ	TEMPORARY SEDIMENT BASIN EXCAVATION	TEMP. SEDIMENT RISER PIPE (____mm)	TURBIDITY CURTAIN PERVIOUS	TURBIDITY CURTAIN IMPERVIOUS	EROSION CONTROL MULCH			
	EACH	METRIC TONS	EACH	m^3	m	m^2	NUMBER Ⓐ	m	EACH	EACH	m^3	m	m	m	m^2			

NOTE: THIS IS A SAMPLE INSERTABLE SHEET. FOR A MORE LEGIBLE AND CURRENT VERSION, ACCESS THE CADD INSERTABLE SHEET DIRECTORY.

ROADSIDE DEVELOPMENT SUMMARY

PROJECT NUMBERS	⊗ TOPSOIL 50 mm CLASS A | B	REGULAR SEED	OVER SEEDING	LIME	FERT. 15-30-15	LEGUME SEED	LEGUME OVER SEEDING
	hectares	kg	kg	metric tons	metric tons	kg	kg

Ⓐ NOT A PAY ITEM. COST TO BE INCLUDED IN OTHER PAY ITEMS.

⊗ DENOTES ITEM(S) TO BE PAID FOR ON BASIS OF PLAN QUANTITIES IN ACCORDANCE WITH CURRENT ROAD AND BRIDGE SPECIFICATIONS.

Rev. 2/97

UNLESS OTHERWISE NOTED, ALL DIMENSIONS ON THIS SHEET ARE IN MILLIMETERS | SPECIAL DESIGN SECTION DRAWING NO. A 4

VDOT METRIC

PLAN NO.	PROJECT	FILE NO.	SHEET NO.
A			

SURVEYED BY ____ SUPERVISED BY ____ DESIGNED BY ____ CADD OPERATOR ____ REVISED BY ____

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