

FOREWORD

To reflect changing socioeconomic, environmental and technological trends and the need for increased fiscal responsibility and accountability, the Department has reviewed its previously adopted highway planning standards and policies.

Based on the findings of the review, the Department has developed this **Transportation Planning Manual (TPM)**. The intent of the TPM is to provide a technical reference document that contains all current departmental highway planning policies and standards. This approach will facilitate consistent, “across-the-board” development of sustainable transportation policies and projects for the provincial highway network. The manual introduces the following new/revised transportation planning standards and policies that have been adopted by the Department:

- ▶ Rural Highways Functional Classification
- ▶ Basic Design and Cross-section Standards
- ▶ Shoulder Widths
- ▶ Paved Shoulders
- ▶ Shoulder Edge Treatments

Explanations of the methodology and reasoning behind the development of each individual policy/standard is given in the Appendices to the manual.

The policies/standards contained in the TPM will be periodically reviewed and updated. Any revisions/edits to existing policies/standards or the introduction of new policies/standards and their subsequent distribution, will be coordinated by the Department's Transportation Systems Planning & Development Branch (TSPDB), 15 th Floor-215 Garry Street, Winnipeg. The contact for any changes, additions or deletions to the TPM will be TSPDB Branch Director. Any questions regarding the contents or application of the policies/standards contained in the TPM should also be directed to the TSPDB Branch Director.

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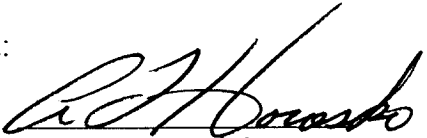
Policy / Standard: TP 1 / 98

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Date: February 2, 1998

**Subject: RURAL HIGHWAYS
FUNCTIONAL
CLASSIFICATION**

Approved:



Deputy Minister

POLICY	Provincial Highways are classified as Expressways, Arterials (Primary and Secondary) and Collectors on the basis of both traffic and land service functions.
PURPOSE	<p>To classify the highways in the Province into groups on the basis of their function serving through traffic and providing access to land.</p> <p>To provide guidance in the development of appropriate and practical policies, standards and procedures for:</p> <ul style="list-style-type: none">▶ Assigning statutory and departmental responsibilities;▶ Establishing work priority;▶ Developing budgets and programs according to priority;▶ Planning, Design; Construction and Maintenance of road system within each class. <p>The Highway Functional Classifications of the Province's Road Network are shown in the enclosed Exhibit A - Provincial Highways Functional Classification Map.</p> <p><i>The methodology and reasoning behind the development of this policy is explained in Appendix A of the Transportation Planning Manual.</i></p>
DEFINITIONS	<p>Expressway:</p> <p>These are generally multi-lane, divided highways (or highways that may/should be multi-laned in the next 30 years) that carry large traffic volumes at high speed under close to free flow conditions. They connect (and sometimes bypass) cities and larger towns and serve industrial, recreational, international and interprovincial traffic. To maintain the flow and safety of through traffic, direct property access is normally eliminated.</p>

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DEFINITIONS CONTD.

Important crossroads may require grade separated interchanges. The relationship between Provincial Trunk Highway (PTH) and the functional classification is that all Expressway routes are defined as existing or future PTHs.

Note: A Freeway is an Expressway with all crossroads and railway crossings grade separated

Rural Arterial:

These are generally a two-lane or, in some cases, multi-lane highways that carry large traffic volumes at high speeds. In conjunction with an expressways, they connect major economic regions and centres of the Province such as cities and towns, industrial concentrations, agricultural areas and major recreational areas. To maintain the flow and safety of through traffic, direct access to abutting land may be restricted or eliminated. This applies particularly in undeveloped areas where lack of other road service may encourage strip development. There are two classes of Arterial highways:

- Primary Arterial** - these routes provide inter-provincial and international connections and direct service to the most important and larger population centres.
- Secondary Arterial** - these routes connects other important population centres.

Note: All arterial routes are defined as existing or potential future PTHs.

Rural Collector:

These collect traffic from local roads and feed it to Arterials, or distribute it from Arterials to local roads. They provide direct service for developments such as tourist attractions, mines, small towns and villages. Collectors serve equally, the function of movement and land access. Collectors are subdivided into categories A, B and C, based on the importance of the resource area, recreation centre, or population node they serve.

Note: Collector routes are generally defined as Provincial Roads. Only in exceptional circumstances would a Collector highway be considered for PTH status. Resource roads may be classified under the

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DEFINITIONS CONTD.

Collector classification. These roads serve resource nodes including mining areas, hydro power sites, oil drilling sites, forestry operations, and major fisheries centres. In cases where the prime purpose of the highway is to connect the resource area to the highway system, the road is classified under the Collector classification.

Special Categories within Functional Class:

To accommodate the unique and specialised characteristics of certain highway routes and their subsequent design and operation, three *Special Categories* have been identified. The design standards for any route that falls under the following three special categories must be obtained through, or developed in conjunction with, the Department's Engineering and Technical Services Division:

National Highway:

A national highway is any existing primary route that provides for interprovincial and international trade and travel by connecting, as directly as possible, a capital city, major provincial population and/or commercial centre in Canada with:

- ▶ another capital city, major provincial population or commercial centre;
- ▶ a major port of entry or exit to the US highway network; and
- ▶ another transportation mode served directly by the highway mode.

Parkway:

A Parkway category is one which limits the construction of the highway to a required special standard due to its scenic, historic, cultural, recreational, archeological or environmental values.

To qualify as a Parkway, a highway has to meet at least one of the following criteria:

- ▶ It passes through a national or provincial park, or a recreational area,
- ▶ It passes through an environmentally sensitive area,

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<p>DEFINITIONS CONTD.</p>	<ul style="list-style-type: none">▶ It has historic value,▶ It is located in rugged or other major terrain constraint area,▶ It serves significant cyclist and pedestrian traffic, and▶ It passes through significantly developed areas. <p>Suburban Highway:</p> <p>These are highways (two or multi-lane) typically located in a suburban community either leading to an urban centre or connecting two or more urban centres. Characteristics of a Suburban Highway typically include:</p> <ul style="list-style-type: none">▶ The visual setting and amount of developed frontage along with the density of both intersections and direct property accesses will fall between that of a rural highway and an urban arterial street.▶ Because of the combination of traffic volumes, density of intersections and direct property accesses, the speed limit will typically be in the 70 - 80 km/h range.▶ Traffic signals may be installed, but the route will lack the regularity of spacing found on an urban arterial street.
<p>PROCEDURE</p>	<p>The work priority, budgets, programs, planning, design, construction, maintenance and operation of provincial highways must be developed taking in consideration the functional classification of highways.</p>

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Policy / Standard: TP 2 / 98

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Date: February 2, 1998

**Subject: BASIC DESIGN AND
CROSS-SECTION STANDARDS**

Approved:


Deputy Minister

POLICY:	The Basic Design and Cross-section Standards (for new construction and major reconstruction) for rural provincial highways.																
PURPOSE:	<p>To provide basic design and cross-section standards to ensure province-wide consistency in the construction and major reconstruction of highways within the same road classification. Additional transportation planning policies have been developed that pertain to basic design standards and cross-sections for Shoulder Width, Paved Shoulders and Shoulder Edge Treatments. These policies should be referred to in conjunction with the attached Table 1 "Basic Design Standards for Provincial Highways (For New and Major Reconstruction) and the Basic Cross-sections for the various classifications of rural provincial highways shown in the attached Figures BCS 1 to 9.</p> <p>The methodology and reasoning behind the development of this policy is explained in Appendix B of the Transportation Planning Manual.</p>																
PROCEDURE:	<p>Except for "<i>Parkway</i>" and "<i>Suburban Highway</i>" special category provincial routes, road designs for all new construction and major reconstruction will conform to the basic design standards (see Table 1) for the following elements based on road classification:</p> <table><tr><td>▪ number of lanes</td><td>▪ lane width</td></tr><tr><td>▪ design speed</td><td>▪ shoulder width</td></tr><tr><td>▪ curvature</td><td>▪ roadbed width</td></tr><tr><td>▪ vertical curve</td><td>▪ median width</td></tr><tr><td>▪ gradient</td><td>▪ right of way</td></tr><tr><td>▪ stopping sight distance</td><td>▪ structure width</td></tr><tr><td>▪ passing sight distance</td><td>▪ structure loading</td></tr><tr><td>▪ surface type</td><td>▪ structure - vertical clearance</td></tr></table>	▪ number of lanes	▪ lane width	▪ design speed	▪ shoulder width	▪ curvature	▪ roadbed width	▪ vertical curve	▪ median width	▪ gradient	▪ right of way	▪ stopping sight distance	▪ structure width	▪ passing sight distance	▪ structure loading	▪ surface type	▪ structure - vertical clearance
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▪ passing sight distance	▪ structure loading																
▪ surface type	▪ structure - vertical clearance																



TRANSPORTATION PLANNING POLICY: TP 2 / 98

BASIC DESIGN STANDARDS FOR PROVINCIAL HIGHWAYS (FOR NEW & MAJOR RECONSTRUCTION)

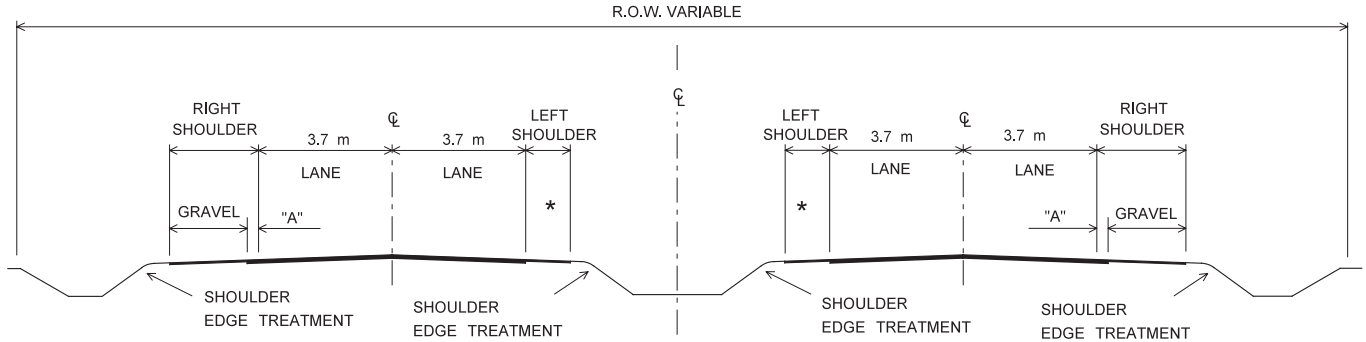
DESIGN CLASSIFICATION (SEE NOTE A)		ESTIMATED 10 - YEAR ANNUAL AVERAGE DAILY TRAFFIC													
		EXPRESSWAYS	TO BE		DETERMINED				BY ANALYSIS						
		PRIMARY ARTERIALS	BY		1000 - 6000 ⁽²⁾		UNDER 1000		1000 - 6000 ⁽²⁾		500 - 1000		UNDER 500 ⁽⁹⁾		
		SECONDARY ARTERIALS	ANALYSIS		1000 - 7000 ⁽²⁾		300 - 1000		UNDER 300						
COLLECTORS		1 ^(E)		2/2G		3		4		5 / 5S1 / 5S2		6			
DRAWING No. (CROSS SECTION)		MULTI - LANE DIVIDED ^(I)		TWO - LANE		TWO - LANE		TWO - LANE		TWO - LANE		TWO - LANE			
NUMBER OF LANES		ALL ^(F)		ALL		FLAT		ROLLING/RUGGED		FLAT		ROLLING		RUGGED	
DESIGN SPEED - km/h		130 ^(A)		120 ^(A)		120 ^(A)		110 ^(A)		120		110		100	
CURVATURE - MINIMUM RADIUS - m ⁽¹⁰⁾		950 ^{(D)(A)}		750 ^(A)		750 ^(A)		600 ^(A)		750		600		440	
VERTICAL CURVE - MIN. K VALUES		S = 65 , C = 120		S = 60 , C = 105		S = 60 , C = 105		S = 55 , C = 85		S=60,C=105		S=55,C=85		S=50,C=70	
GRADIENT - MAXIMUM PERCENT ⁽³⁾		3 ^(A)		3 ^(A)		3 ^(A)		5 ^(A)		3		6		7	
STOPPING SIGHT DISTANCE - m		260 ^(A)		240 ^(A)		240 ^(A)		220 ^(A)		240		220		200	
PASSING SIGHT DISTANCE - m ⁽⁴⁾		NOT APPLICABLE		800		800		740		800		740		680	
SURFACE TYPE		CONCRETE OR BITUMINOUS PAVEMENT		CONCRETE OR BITUMINOUS PAVEMENT		CONCRETE OR BITUMINOUS PAVEMENT		CONCRETE OR BITUMINOUS PAVEMENT		CONCRETE OR BITUMINOUS PAVEMENT		SURFACE TREATMENT ⁽⁷⁾		GRAVEL ⁽⁹⁾	
LANE WIDTH - m		3.7		3.7		3.7		3.7		3.7		3.7 ⁽⁹⁾		N. A.	
SHOULDER WIDTH - m		2-3 RIGHT 1-1.5 LEFT ^{(8)(A)}		3.0 ^{(8)(A)}		2.5 ^{(8)(A)}		2.0 ^{(8)(A)}		2.0 ^{(8)(A)}		1.0 - 1.5 ^{(8)(9)(A)}		N. A.	
ROADBED WIDTH - m		VARIABLE		VARIABLE		VARIABLE		VARIABLE		VARIABLE		VARIABLE ⁽⁹⁾		8 8.4 8.4	
MEDIAN - m		DEPRESSED ⁽⁵⁾		15 MINIMUM 20-40 NORMAL		N. A.		N. A.		N. A.		N. A.		N. A.	
WIDTH		CURBED ⁽⁶⁾		5-12 NORMAL		N. A.		N. A.		N. A.		N. A.		N. A.	
RIGHT OF WAY - m		AS REQUIRED		60		60		60		60		50 ⁽⁹⁾		45 50 50	
STRUCTURES WIDTHS BASED ON THE ASSUMPTION OF 1.2 m INCREMENTS		CLEAR WIDTH ^(B)		UNDER 60 m LONG		PAVEMENT PLUS SHOULDERS		13.2		12.0		12.0		9.6 - 10.8	
		60 m LONG		10.8 ^(C)		10.8		9.6		9.6		9.6		9.6	
LOADING		HSS 25 TRUCK OR HS 30 (LANE LOADING) FOR PTH OR MAJOR PR STRUCTURES. HSS 25 FOR MINOR PR STRUCTURES.													
VERTICAL CLEARANCE		ALL 5.0 m (ALLOWS FOR 0.1 m RESURFACING DEPTH)													

NOTE: IN GENERAL THESE STANDARDS ARE A MINIMUM, TO BE BETTERED WHEN FEASIBLE, LOWERING MAY BE CONSIDERED WHEN HEAVY ECONOMIC PENALTY OR MAJOR ENVIRONMENTAL IMPACT RESULTS.

1. FULL CONTROL OF ACCESS WHENEVER POSSIBLE: No. OF LANES DETERMINED BY CAPACITY ANALYSIS.
2. FACTORS SUCH AS ECONOMICS, SAFETY, HOURLY FLOWS, TRUCK TRAFFIC, SEASONAL VARIATIONS, THE FUNCTION OF THE HIGHWAY, AND ENVIRONMENTAL CONSIDERATIONS HAS A BEARING ON THE DECISION TO FOUR LANE.
3. ALL GRADES SHOULD BE REVIEWED FOR SLOPE AND LENGTH TO DETERMINE IF THERE IS A NEED FOR A TRUCK CLIMBING LANE.
4. IT IS DESIRABLE TO PROVIDE PASSING SIGHT DISTANCE ON A MINIMUM 25% OF ANY 2 km AND A MINIMUM OF 50% IN ANY 15 km.
5. MEDIAN WIDTH INCLUDES THE INSIDE SHOULDER.
6. MEDIAN WIDTH MAY INCLUDE A 0.3 - 0.5 m CURB OFFSET (CURB NOT RECOMMENDED FOR RURAL AND HIGH SPEED ROADWAYS).
7. BASE COURSE AND ASPHALT SURFACE TREATMENT OR CALCIUM CHLORIDE ON WELL DRAINED A3 OR BETTER SOILS; HEAVIER PAVEMENT , IF WARRANTED, ON POORLY DRAINED A4-A7 SOILS.
8. SEE APPLICABLE CROSS SECTION FOR PAVED SHOULDER TREATMENT (BASED ON THE PAVED SHOULDER POLICY).
9. CONSIDER STAGE CONSTRUCTION, IF SURFACE TREATMENT NOT POSSIBLE FOR 5-10 YEARS OR IF THE FUNCTION OF THE HIGHWAY SO WARRANTS.
10. HORIZONTAL CURVE DATA BASED ON MAXIMUM SUPERELEVATION OF 6%.

<p>^(A) FOR DESIGN SPEED AND ASSOCIATED PARAMETERS ON MULTI-LANE COLLECTORS, NATIONAL HIGHWAYS, PARKWAYS AND SUBURBAN HIGHWAYS. CONSULT ENGINEERING & TECHNICAL SERVICES.</p> <p>^(B) OTHER FEATURES IN THE VICINITY OF THE STRUCTURE SUCH AS INTERSECTIONS, ROAD CURVATURE, THE NEED FOR A SIDEWALK, ETC., COULD AFFECT THE REQUIRED STRUCTURE WIDTH. CLEAR WIDTH IS "IN TO IN" OF CURBS.</p> <p>^(C) WIDTH OF 2 LANE, 1 - WAY OVERPASS. FOR MORE THAN 4 LANE DIVIDED OR FOR UNDERPASS, CONSULT ENG. & TECH. SERVICES.</p> <p>^(D) MINIMUM RECOMMENDED RADIUS: 1100 - 1200 m ON TRANS CANADA HIGHWAY</p> <p>^(E) STANDARDS FOR FRONTAGE/SERVICE ROADS AS PER DRAWING No. 5 OR 6 (EXCEPT FOR RIGHT OF WAY REQUIREMENTS.)</p> <p>^(F) USE OF RUGGED TERRAIN STANDARDS MUST BE JUSTIFIED ON BASIS OF SUCH FACTORS AS SIGNIFICANT REDUCTION IN CONSTRUCTION COSTS AND ENVIRONMENTAL IMPACTS. ONLY TO BE CONSIDERED WITHIN SUCH AREAS AS THE WESTERN UPLANDS, DEEP RIVER VALLEYS AND THE CANADIAN SHIELD.</p>	<p>RECOMMENDED BY _____</p> <p>APPROVED BY _____</p> <p style="text-align: center;">DIRECTOR, TRANSPORTATION SYSTEMS PLANNING & DEVELOPMENT</p> <p style="text-align: center;">DIRECTOR, HIGHWAY PLANNING & DESIGN</p> <p style="text-align: center;">A.D.M. TRANSPORTATION POLICY, PLANNING & DEVELOPMENT</p> <p style="text-align: center;">A.D.M. ENGINEERING & TECHNICAL SERVICES</p>
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4-LANE DIVIDED (SEE NOTE)



"A" = 0.6 m FOR CONCRETE PAVEMENT
 = 0.8 m FOR BITUMINOUS PAVEMENT

* BITUMINOUS PAVEMENT

	LEFT SHOULDER	RIGHT SHOULDER
EXPRESSWAY	1.5 m	3.0 m
ARTERIAL	1.2 m	3.0 m **
COLLECTOR	1.0 m	2.0 m

** 2.5 m FOR SECONDARY ARTERIAL

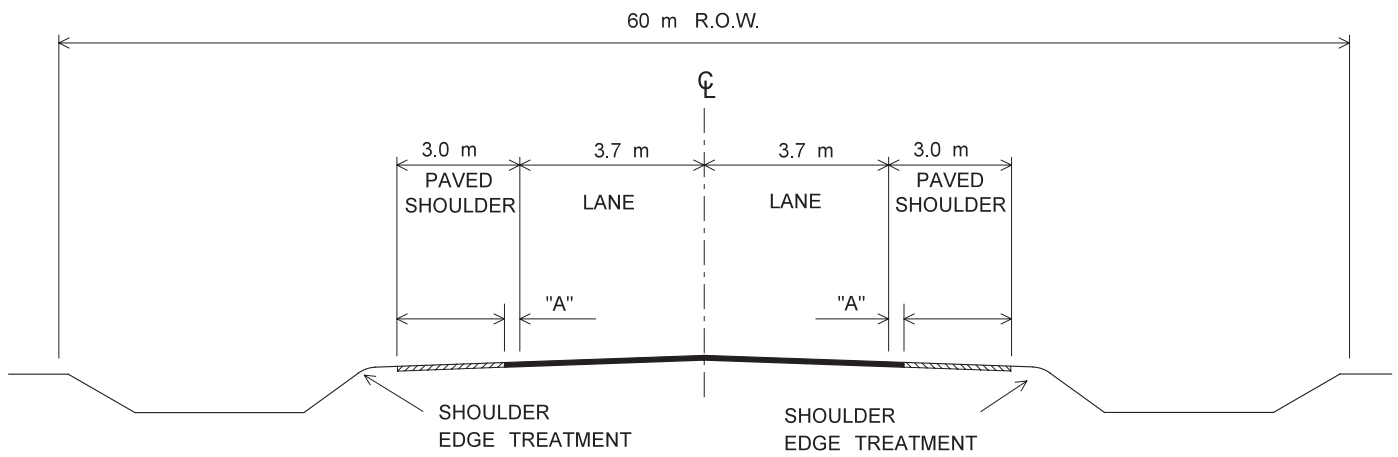
NOTE :
 FOR EXPRESSWAY AND ARTERIAL HIGHWAYS WITH 10 YR AADT IN THE 6000 v/d RANGE AND COLLECTOR ROUTES IN THE 7000 v/d RANGE,
 AN ECONOMIC ANALYSIS SHOULD BE UNDERTAKEN TO JUSTIFY CONSTRUCTION OF A MULTI-LANED DIVIDED HIGHWAY

BASIC CROSS-SECTION 1

Figure: BCS 1

Figure: BCS 2

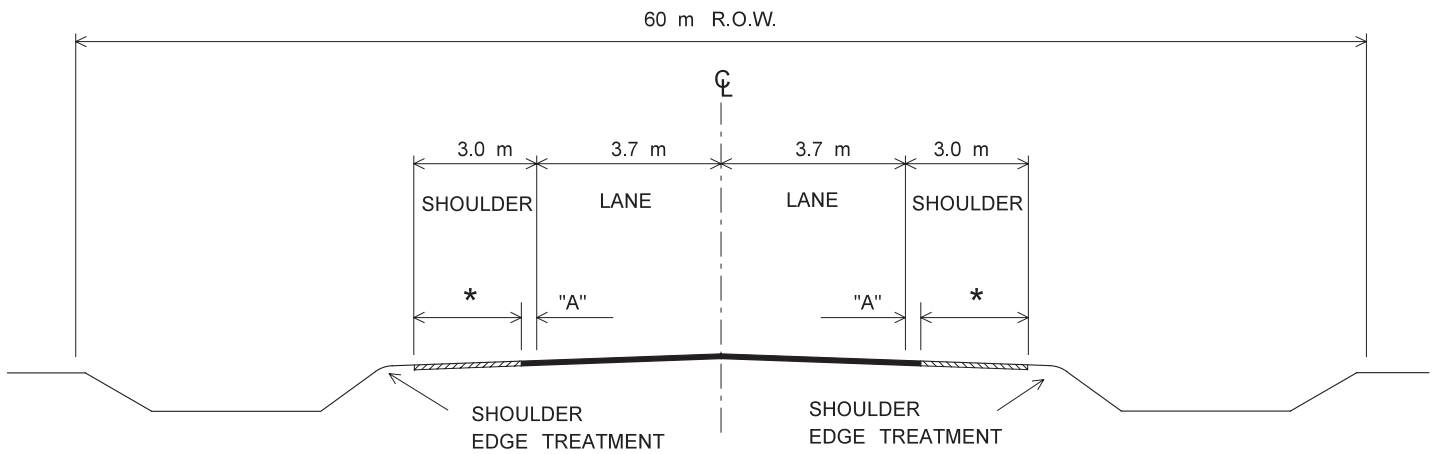
2 LANE NATIONAL HIGHWAYS AND
PRIMARY ARTERIAL (EXISTING AADT > 3500)



"A" = 0.6 m FOR CONCRETE PAVEMENT

BASIC CROSS-SECTION 2

PRIMARY ARTERIAL 10 YR. AADT > 1000



"A" = PAVED PORTION OF SHOULDER
= 0.6 m FOR CONCRETE PAVEMENT
= 0.8 m FOR BITUMINOUS PAVEMENT

* GRAVEL (CONSIDER HARD SURFACING SHOULDERS IF THE CRITERIA CONTAINED IN TRANSPORTATION PLANNING POLICY: TP 4/98 "PAVED SHOULDER CRITERIA AND DESIGN STANDARDS" IS MET).

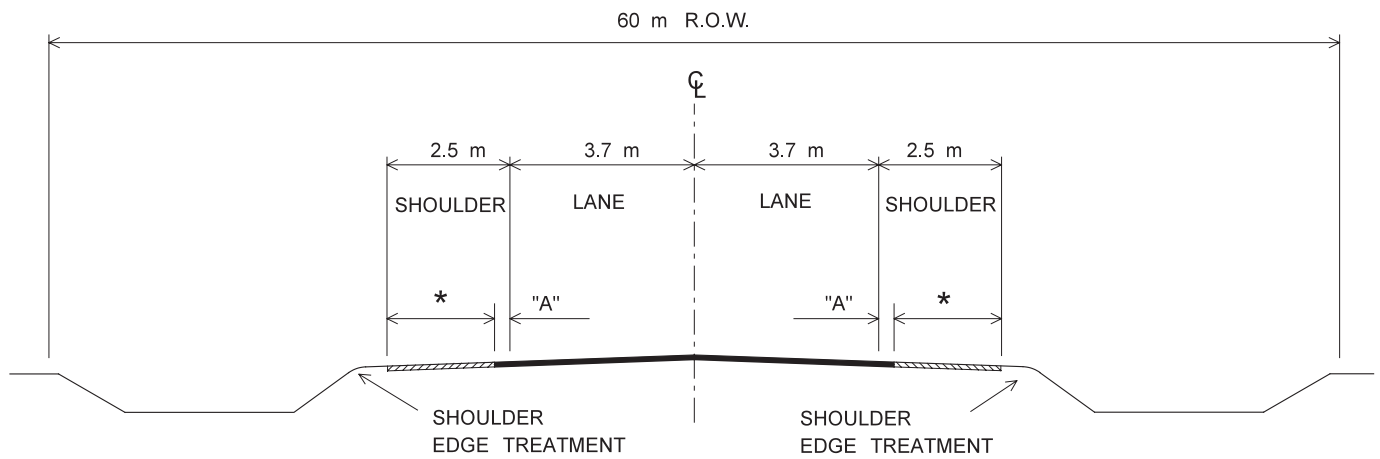
NOTES :

1. FOR NATIONAL HIGHWAYS USE CROSS SECTION 2
2. FOR PRIMARY ARTERIALS WITH EXISTING AADT > 3500, USE CROSS SECTION 2

BASIC CROSS-SECTION 2G

Figure: BCS 4

PRIMARY ARTERIAL (10 YR. AADT < 1000)
SECONDARY ARTERIAL (10 YR. AADT > 1000)



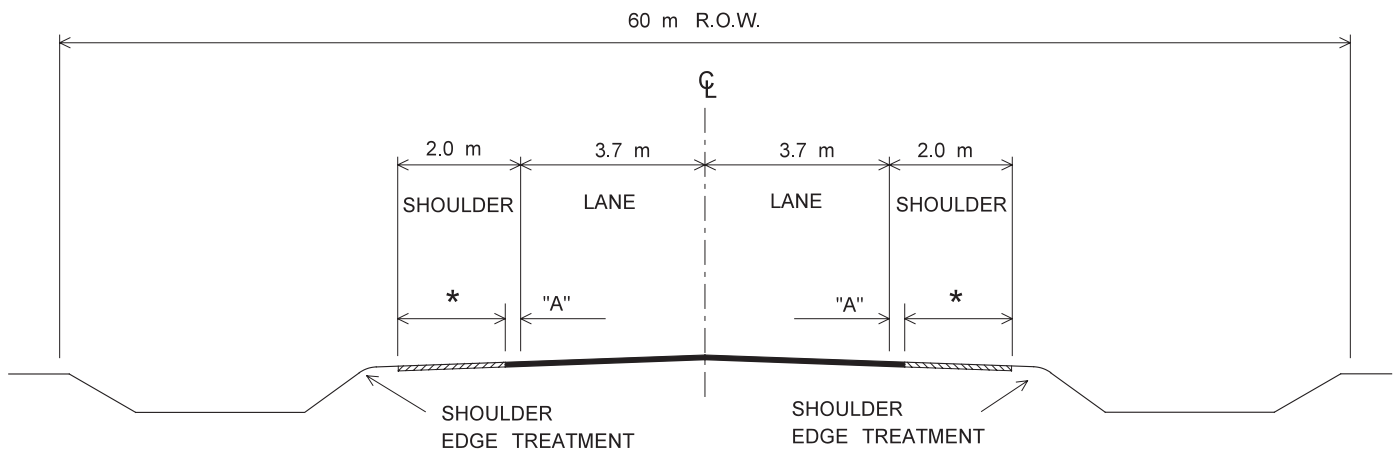
"A" = PAVED PORTION OF SHOULDER
= 0.6 m FOR CONCRETE PAVEMENT
= 0.8 m FOR BITUMINOUS PAVEMENT
= 0.0 m GRAVEL FOR PRIMARY ARTERIAL WITH EXISTING AADT < 500
= 0.0 m GRAVEL FOR SECONDARY ARTERIAL WITH EXISTING AADT < 1000

* GRAVEL (CONSIDER HARD SURFACING SHOULDERS IF THE CRITERIA CONTAINED IN TRANSPORTATION PLANNING POLICY: TP 4/98 "PAVED SHOULDER CRITERIA AND DESIGN STANDARDS" IS MET).

BASIC CROSS-SECTION 3

Figure: BCS 5

SECONDARY ARTERIAL (10 YR. AADT 500 TO 1000)
COLLECTOR (10 YR. AADT > 1000)



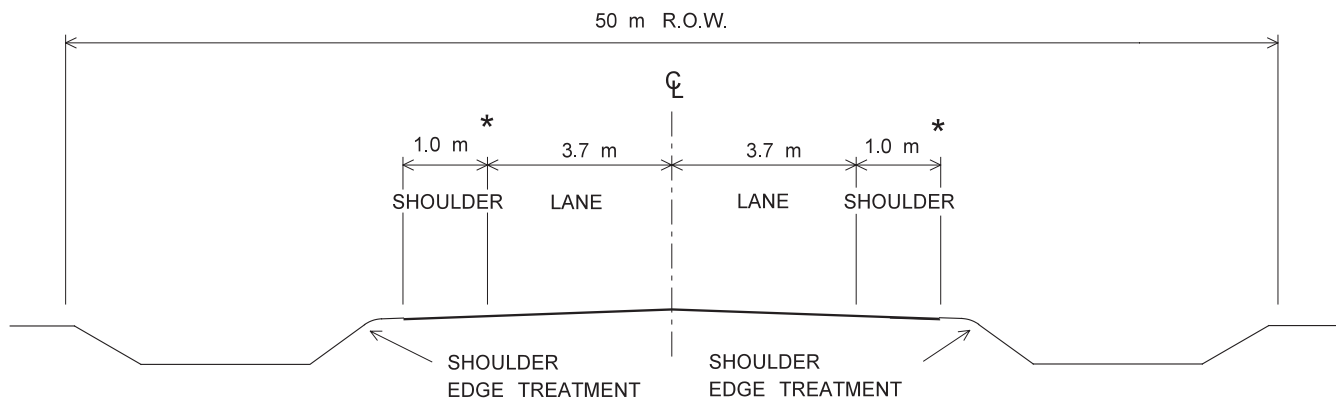
"A" = PAVED PORTION OF SHOULDER
= 0.6 m FOR CONCRETE PAVEMENT
= 0.8 m FOR BITUMINOUS PAVEMENT
= 0.0 m GRAVEL FOR HIGHWAYS WITH EXISTING AADT < 1000

* GRAVEL (CONSIDER HARD SURFACING SHOULDERS IF THE CRITERIA CONTAINED IN TRANSPORTATION PLANNING POLICY: TP 4/98 "PAVED SHOULDER CRITERIA AND DESIGN STANDARDS" IS MET).

BASIC CROSS-SECTION 4

Figure: BCS 6

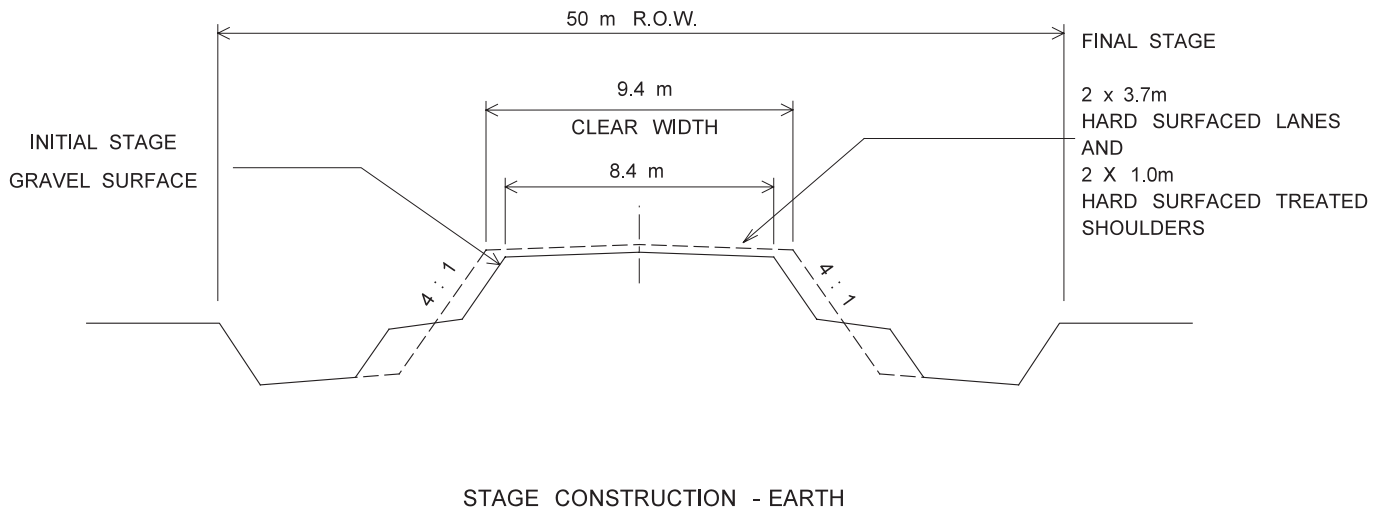
SECONDARY ARTERIAL (10 YR. AADT 300 TO 500)
COLLECTOR (10 YR. AADT 300 TO 1000)



* MINIMUM 1.5 m HARD SURFACED SHOULDERS TO ACCOMMODATE OTHER ROAD USERS IF THE CRITERIA IN TRANSPORTATION POLICY: TP 4/98 (PAVED SHOULDERS CRITERIA AND DESIGN STANDARDS) IS MET.

BASIC CROSS-SECTION 5

SECONDARY ARTERIAL (10YR. AADT < 300)
COLLECTOR (10YR. AADT 300 RANGE)

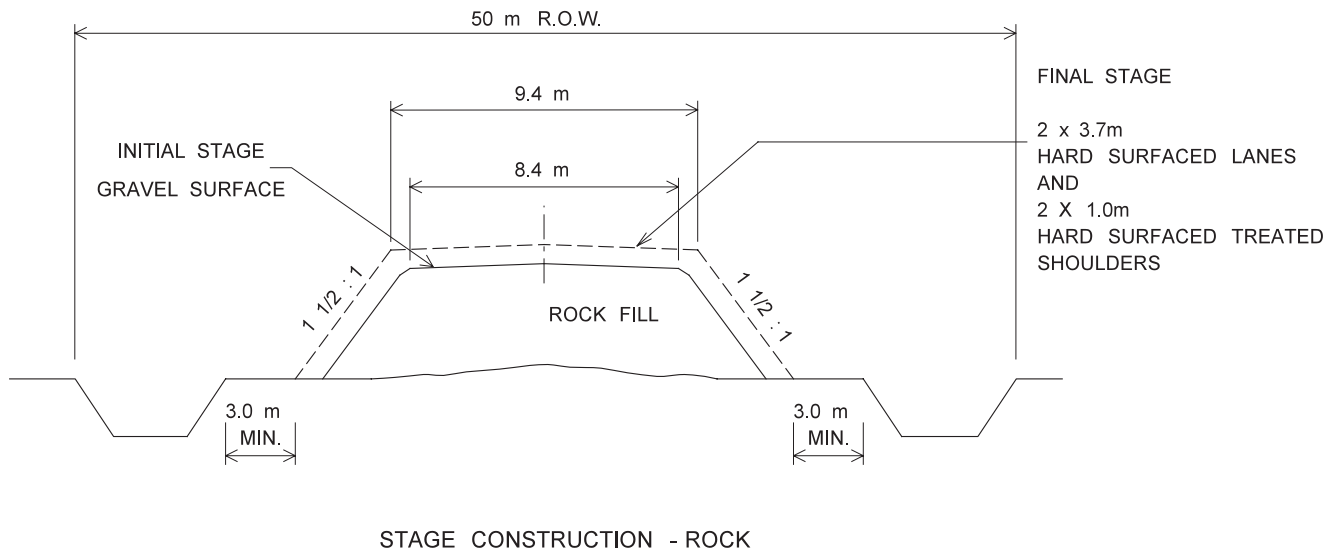


BASIC CROSS-SECTION No. 5.S1

Figure: BCS 8

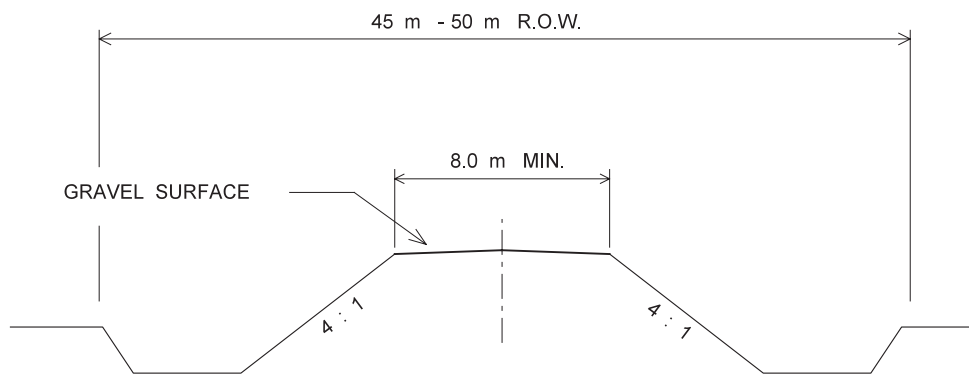
SECONDARY ARTERIAL (10YR. AADT < 300)

COLLECTOR (10YR. AADT 300 RANGE)



BASIC CROSS-SECTION No. 5.S2

COLLECTOR (10 YR. AADT LESS THAN 300)



NOTE: FOR ROLLING TERRAIN TOP WIDTH TO BE 8.4 m.

BASIC CROSS-SECTION No. 6

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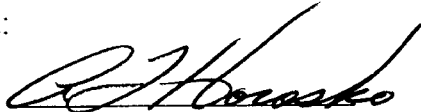
Policy / Standard: TP 3 / 98

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Date: February 2, 1998

**Subject: SHOULDER WIDTH
POLICY**

Approved:


Deputy Minister

POLICY	Design standards for shoulder widths are a function of the number of lanes, functional highway classification and AADT.
PURPOSE	<p>To set out design standards for shoulder widths for new construction and reconstruction.</p> <p>The methodology and reasoning behind the development of Policy TP 3 / 98 is explained in Appendix B of the Transportation Planning Manual (<i>Basic Design and Cross-section Standards - Background / Reference Material associated with Transportation Planning Policy: TP 2 / 98</i>).</p>
PROCEDURE	Shoulder widths will conform to the design standards specified on page 2.

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Policy / Standard: TP 3 / 98

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SHOULDER WIDTH DESIGN STANDARDS

4-Lane Divided Highway	Left Shoulder	Right Shoulder
Expressway	1.5 m	3.0 m
Primary Arterial	1.2 m	3.0 m
Secondary Arterial	1.2 m	2.5 m
Collector	1.0 m	2.0 m
 2-Lane Highways		Shoulder Width
National Highways		3.0 m
Primary Arterials 10 YR AADT > 1000		3.0 m
Primary Arterial 10 YR AADT < 1000		2.5 m
Secondary Arterial 10 YR AADT > 1000		2.5 m
Secondary Arterial 10 YR AADT 500 - 1000		2.0 m
Collector 10 YR AADT > 1000		2.0 m
Secondary Arterial 10 YR AADT 300 - 500		1.0 m *
Collector 10 YR AADT 300 - 500		1.0 m *
Secondary Arterial / Collector 10 YR AADT < 300		0.3 - 0.5 m (gravel roads)

*** Minimum 1.5 m hard surfaced shoulders to accommodate other road users if the criteria in Transportation Planning Policy: TP 4 / 98 (Paved Shoulders Criteria and Design Standards) is met.**

TRANSPORTATION PLANNING


Policy / Standard: TP 4 / 98

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Date: February 2, 1998

**Subject: PAVED SHOULDER
POLICY**

Approved:


Deputy Minister

POLICY	Consideration will be given for shoulder paving if the highway meets the established criteria.
PURPOSE	To provide criteria and design standards for shoulder paving. The methodology and reasoning behind the development of Policy TP 4 / 98 is explained in Appendix A of the Transportation Planning Manual (<i>Basic Design and Cross-section Standards - Background / Reference Material associated with Transportation Planning Policy: TP 2 / 98</i>).
PROCEDURE	Road shoulders may be paved when the highway complies with the criteria specified on page 2.

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Policy / Standard: TP 4 / 98	Page 2 of 2	Date: February 2, 1998
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PAVED SHOULDER CRITERIA AND DESIGN STANDARDS

Resurfacing of Existing Highways with Paved Shoulders

<u>Bituminous Surface</u> Preserve existing paved shoulder subject to geometric standards	<u>Concrete</u> Preserve existing paved shoulder subject to geometric standards
--	--

New Construction and Reconstruction

No. of Lanes	Functional Classification/ Existing AADT	Bituminous Surface	Concrete Surface
4-Lane Divided	Expressway Arterial Collector	outside: 0.8 m bituminous paved strip inside: fully paved bituminous	outside: 0.6 m concrete strip inside: fully paved bituminous
2-Lane	- National Highway System - Primary Arterials with AADT >3500	Full width paved	Two 4.3 m concrete lanes (3.7 m lane and 0.6 m concrete strip, plus bituminous shoulder)
	Primary Arterials with AADT > 500 Other 2-lane highways with AADT >1000	0.8 m paved strip	0.6 m concrete paved strip
	All others	gravel	gravel

Consideration be given for full width paved / hard surfaced shoulders for roads having:

- 1) Posted speed \leq 50 km/h 2) Posted speed of 50-70 km/h and local conditions dictate. (Eg. pedestrians, cyclists). 3) Route continuity

New Asphalt Treated Highway

AST Gravel-based Highway	Full width seal (for roads whose final surface is AST)
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TRANSPORTATION PLANNING

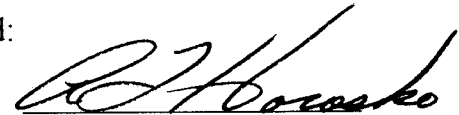
Policy / Standard: TP 5 / 98

Page 1 of 1

Date: February 2, 1998

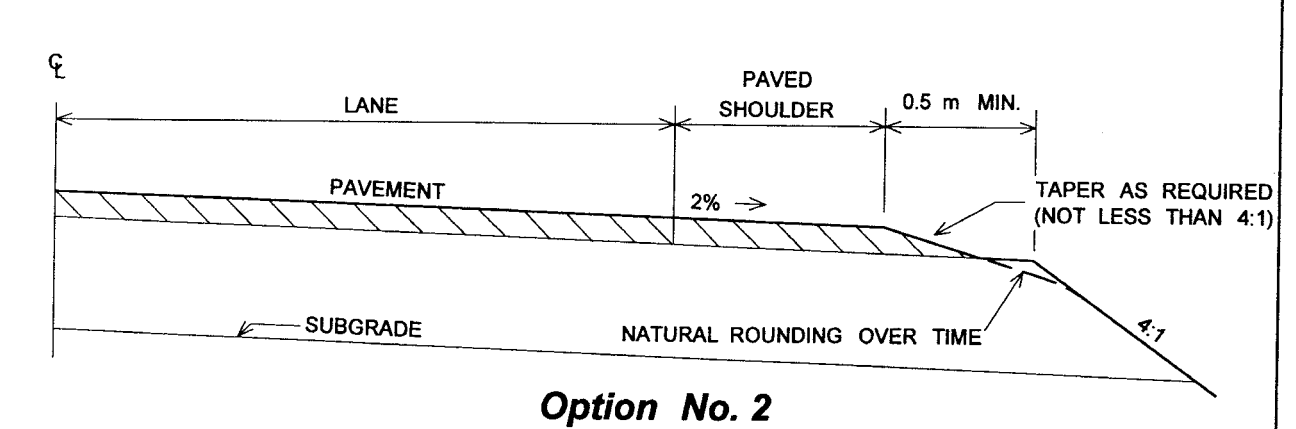
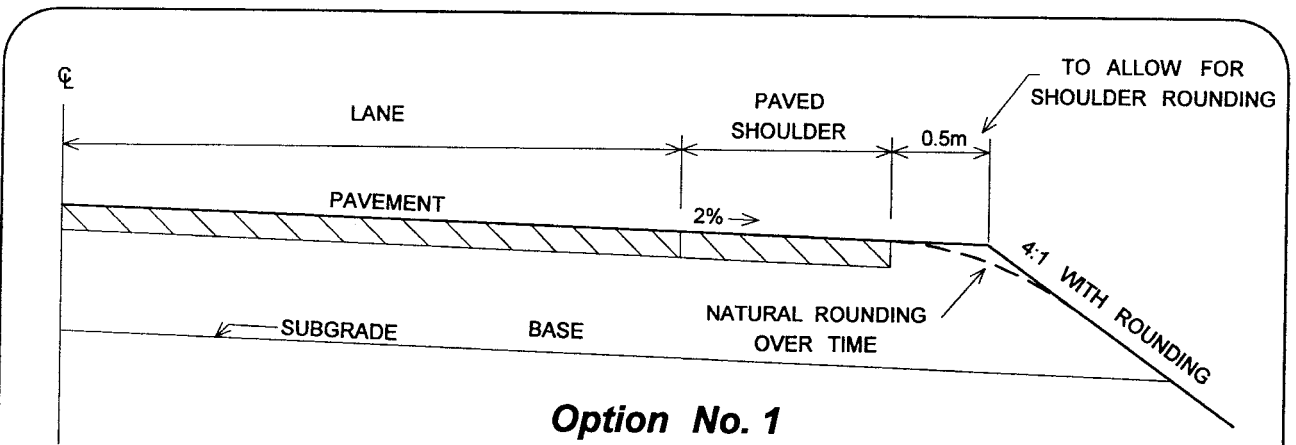
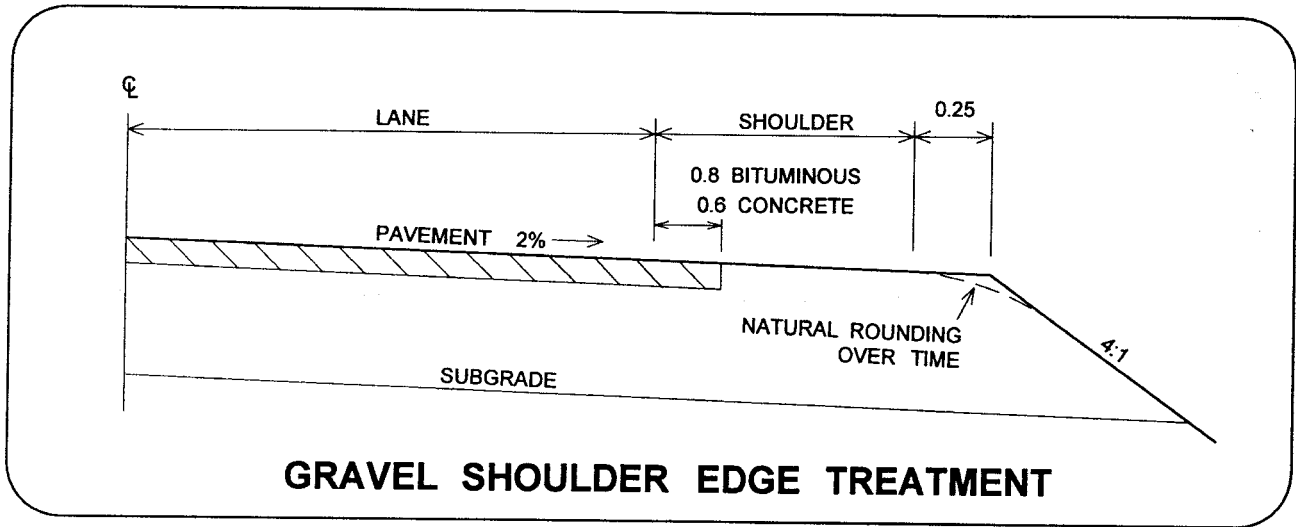
**Subject: SHOULDER EDGE
TREATMENT POLICY**

Approved:


Deputy Minister

POLICY	Shoulder end treatment is the recommended standard for all highways to provide for a smooth change in cross fall from shoulder slope to side slope.
PURPOSE	<p>To enhance vehicle safety, prevent edge wash out, increase lateral support, eliminate pavement drop off, facilitate future overlay without grade widening, and ease the construction of fully paved shoulders.</p> <p>The methodology and reasoning behind the development of Policy TP 5 / 98 is explained in Appendix B of the Transportation Planning Manual (<i>Basic Design and Cross-section Standards - Background / Reference Material associated with Transportation Planning Policy: TP 2 / 98</i>).</p>
PROCEDURE	<p>Gravel Shoulder Edge Treatment Cross-section (see attached diagram) provides for a 0.25 m extension of the shoulder to allow for natural rounding over time.</p> <p>Paved Shoulder Edge Treatment Two paved shoulder options (see attached cross-section diagrams) are acceptable. Option chosen at the discretion of the project engineer.</p> <p><i>Option 1</i> Extending the paved shoulder with 0.5 m of gravel to allow for natural rounding.</p> <p><i>Option 2</i> Providing for an additional 0.5 m of paved shoulder, tapered as required.</p> <p>Note: In the case of both gravel and paved shoulder edge treatments associated with rehabilitation projects, the shoulder extension could be lowered to 0.2 m.</p>

SHOULDER EDGE TREATMENT POLICY TP: 5 / 98



PAVED SHOULDER EDGE TREATMENT

NOTE: SUBGRADE WIDTH = $2 \times [\text{LANE WIDTH} + \text{SHOULDER WIDTH} + 0.5 + 4 \times (\text{BASE} + \text{PAVEMENT DEPTH})]$

TRANSPORTATION PLANNING POLICY : TP 1 / 98

**A HIGHWAY FUNCTIONAL CLASSIFICATION
SYSTEM FOR RURAL PROVINCIAL HIGHWAYS
IN MANITOBA**

**BACKGROUND / REFERENCE
MATERIAL**

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Exhibits

Exhibit A	Provincial Highway Functional Classification Map (June 1997)* <i>(*Refer to Transportation Planning Policy: TP 1 / 98 "Rural Highways Functional Classification" for a copy of the 'Exhibit A' Map.)</i>	
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GENERAL INTRODUCTION

Introductory Note: For more detailed information on the background, methodology, and reasoning behind the development of Transportation Planning Policy: TP 1 / 98 (Functional Classification of Rural Provincial Highways) refer to the Transportation Systems Planning & Development Branch's "*A Functional Highway Classification System for Rural Provincial Highways in Manitoba - July 1997 Report*".

A classification system provides guidance to the highway authority in the following areas:

- ▶ to establish logical, integrated systems composed of all roads and streets, which because of their service, should be administered by the same jurisdiction;
- ▶ to provide a basis for assigning the responsibility for each class of road to the level of government with the greatest interest; and
- ▶ to group roads and streets that require the same quality of construction

(a) Administration:

Road classification is used in the areas of strategic planning and policy development. The grouping of roads with similar construction, maintenance and operational needs provides a basis for assigning statutory and departmental responsibility. Road classification also serves as a criterion for the allocation of resources. (eg: programming and expenditure control).

(b) Planning, Environmental and Design Considerations:

The classification of roads allows highways to be built to consistent standards. It also facilitates the use of a systematic approach to the development of design standards while considering the impact to the natural environment and road service.

A systematic approach can also be used for controlling land use, access, subdivision, and other developments adjacent to highways to ensure public safety, mobility and to protect costly highway investment.

METHODOLOGY

i) Definitions

The first task was to define the highway classes (see **Figure 1 - Highway Classifications and Functions - next page**). The slightly modified Transportation Association of Canada (TAC) definitions used in the 1986 Manitoba Highway Classification Study were again applied to suit the conditions in Manitoba. The definition used for Expressway, Arterial and Collector classifications are given below:

Rural Expressway:

These are generally multi-lane, divided highways (or highways that may/should be multi-laned in the next 30 years) that carry large traffic volumes at high speed under close to free flow conditions. They connect (and sometimes bypass) cities and larger towns and serve industrial, recreational, international and interprovincial traffic. To maintain the flow and safety of through traffic, direct property access is normally eliminated. Important crossroads may require grade separated interchanges.

Note: A Freeway is an Expressway with all crossroads and railway crossings grade separated.

Rural Arterial:

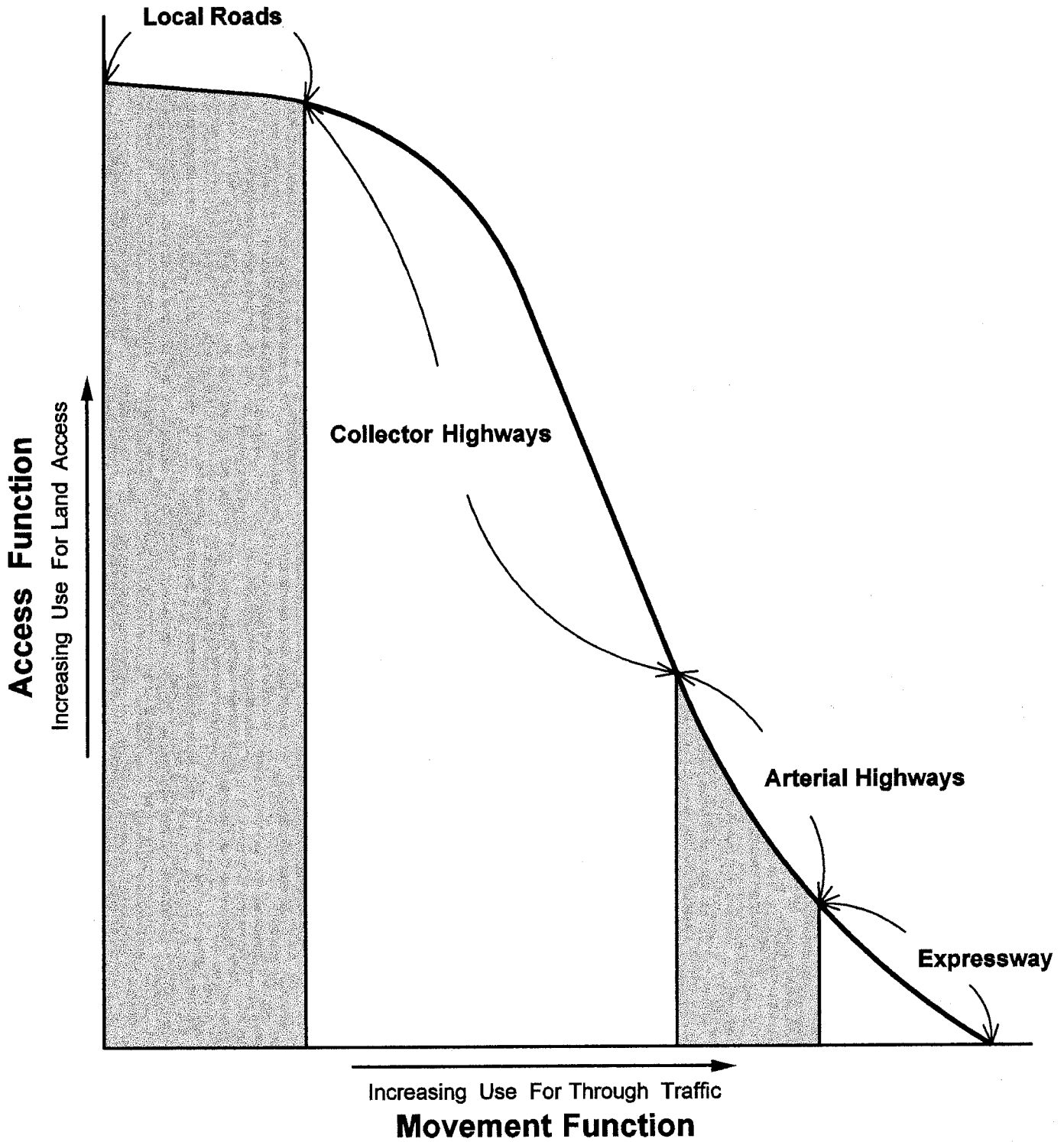
These are generally two-lane or, in some cases, multi-lane highways that carry large traffic volumes at high speeds. In conjunction with Expressways, they connect major economic regions and centres of the Province such as cities and towns, industrial concentrations, agricultural areas and major recreational facilities. To maintain the flow and safety of through traffic, direct access to abutting land may be restricted or eliminated. This applies particularly in undeveloped areas where lack of other road service may encourage strip development. There are two classes of Rural Arterial highways:

Primary Arterials provide intra/inter-provincial and international connections and direct service to the most important and larger population centres.

Secondary Arterials connect other important population centres.

Figure 1

Highway Classifications & Functions



Rural Collector:

Rural Collector routes provide a traffic link between Arterial highways and local roads. They also provide direct service for developments such as tourist attractions, recreational areas, mines, small towns and villages. Collector routes equally serve the function of movement and land access and are subdivided into categories A, B and C, based on population size and the importance of the resource area or recreation area served. Resource Roads may be classified under the Collector classification.

Collector A is the highest ranking and Collector C is the lowest ranking. The breakdown of these classes is mainly required for programming of capital works, development and access control, and operational purposes. As the aim of the Department is to serve the Province at large, it was felt that that no "local" road classifications should be included as they are, in most cases, considered a municipal responsibility.

Based on the above discussions, pavements for all Expressway and Arterial routes (whose major function is to accommodate truck traffic for movements of goods) should be designed and constructed to carry TAC loading and to withstand single axle loads of 9100 kg. Unless justified otherwise, all other provincial highways should be designed and constructed to carry single axle loads of 8200 kg. All new roads should be designed to carry either TAC or B1 loading standards and the present practice of designing A1 roads should be dropped.

The next step was to establish the class ranking of the highway system. This was done by defining those nodes which the highway system will link.

ii) Nodes

The nodes used to define the Expressway (multi-lane divided highways), Arterial (Primary and Secondary) and Collector links included population centres, recreation centres, resource extraction areas and other areas of major economic activity. The relationship between the three basic nodes (ie; population centre, recreation centre and resource extraction areas) and its size to road classification are:

(a) Population Nodes

Population Nodes (includes cities, towns, villages and First Nation Reserves) provide the most viable highway class ranking linkage. The highway/population node links were defined as follows:

<u>Link Classification</u>	<u>Connecting Population Nodes</u>
Expressway/Primary Arterial	Greater than 10,000
Secondary Arterial	1,000 to 10,000
Collector A	500 to 1,000
Collector B	50 to 500
Collector C	Less than 50

(b) Recreation Nodes

These are areas of major recreational activity such as parks and recreation centres. The major traffic to these nodes is during the summer months. In view of this, the nodes were defined in terms of visitations to these areas during the four summer months (June to September).

<u>Link Classification</u>	<u>Connecting Recreation Nodes</u>
Expressway/Primary Arterial	Greater than 30,000*
Secondary Arterial	15,000 to 30,000*
Collector A	8,000 to 15,000*
Collector B	2,000 to 8,000*
Collector B	Less than 2,000*

*** Denotes Visitors**

(c) Resource Nodes

These nodes included mining resource areas, hydro power sites, oil drilling sites and major fisheries centres as well as those places where resource extraction is underway or is anticipated to commence within the next five years. In cases where the prime purpose of the highway is simply to connect the resource area to the highway system, the road is classified under the Collector classification.

Having established the larger nodes, the Expressway and Arterial highway network was first determined. The linkages between the larger nodes formed this network. In cases where more than one highway joined nodes, the most viable link was selected. This process was repeated for all the nodes and classes of highway until the complete highway system network was developed. Upon completion of the network, each linkage was re-examined, evaluated and, in some cases, upgraded or downgraded allowing for special conditions. Input from Senior Regional Staff, other Branches of the Department and selected stakeholders was important in this regard.

Two classes of Arterial Highways were established, namely *Primary Arterial* and *Secondary Arterial*. Primary Arterials are the more important links because they provide intra/inter-provincial and international connections and direct service to the most important and larger population centres. Secondary Arterials connect other important population centres within the province.

iii) Special Categories

Three new categories were identified within the existing road classification groups (expressway, arterial and collector) to accommodate the special characteristics and/or local conditions associated with certain routes. These new categories are:

- 1) National Highway
- 2) Parkway
- 3) Suburban Highway

1) **National Highway:**

A National Highway is any primary route that facilitates interprovincial and international trade and travel by connecting, as directly as possible, a capital city, major provincial population or commercial centre in Canada with:

- ▶ another capital city, major provincial population or commercial centre;
- ▶ a major port of entry or exit to the US highway network; and
- ▶ another transportation mode served directly by the highway mode.

The National Highways in Manitoba are PTH 1, PTH 16, PTH 29, PTH 75, PTH 100, and PTH 101 (proposed).

2) **Parkway:**

A Parkway route is a highway where its construction to required standards is inhibited

due to associated scenic, historic, cultural, recreational, archeological or environmental values and/or terrain constraints.

A highway has to meet at least one of the following criteria to qualify as a Parkway:

- ▶ It passes through a national or provincial park, or recreational area,
- ▶ It passes through an environmentally sensitive area,
- ▶ It has historic value,
- ▶ It is located in rugged or other major terrain constraint area,
- ▶ It serves significant cyclist and pedestrian traffic, and,
- ▶ It passes through significantly developed areas.

Some examples of Parkways are: PTH 8 in Hecla, PR 238, PTH 44 (PTH 1 East to PTH 11), and PTH 10 (Onanole North to Riding Mountain Park Boundary).

3) Suburban Highway:

These are highways (two or multi-lane) typically located in a suburban community either leading to an urban centre or connecting two or more urban centres.

Characteristics of a Suburban Highway typically include:

- ▶ The visual setting and amount of developed frontage along with the density of both intersections and direct property accesses will fall between that of a rural highway and an urban arterial street.
- ▶ Because of the combination of traffic volumes, density of intersections and direct property accesses, the speed limit will typically be in the 70 - 80 km/h range.
- ▶ Traffic signals may be installed but, the route will lack the regularity of spacing found on an urban arterial street.

Because of the level of developed frontage, each Suburban Highway has its own set of constraints for design and construction. The design speed and in some cases cross section and drainage requirements may generally be lower than that of a rural highway.

Some examples of Suburban Highways are: PTH 9 (PTH 101 to Selkirk), PTH 204 (PTH 101 to Lockport), PTH 1 West through Headingley and PTH 1 West through Brandon.

(iv) Access and Land Use Control

Land use, development and access control linked to functional classification enables the Department to plan major roadways (see **Figure 2 - Highway Classifications - Land Use Controls on page 10** and **Figure 3 - Highway Classifications - Land Use on page 11**) by minimizing interference from adjacent properties and communities. When applied on a consistent province-wide basis, land use and development control with appropriate access spacing preserves the safety of the highway user, the traffic carrying capacity of a highway, and the public's investment into the infrastructure. It also minimizes the impact of a highway on adjoining lands and communities.

The controls are affected by:

- regulating right of access from adjacent private landowners by legislation;
- selectively limiting the number of approaches on a highway;
- requiring specific design criteria to be met for access points;
- specifying the permitted use of an approach to a particular type of vehicle;
- limiting the use of driveways to a specific type of land use; or
- any combination of the foregoing.

Access should be limited on those routes identified in **Exhibit A "Provincial Highway Functional Classification Map - June 1997"** (Note: refer to **Transportation Planning Policy: TP 1 / 98 "Rural Highways Functional Classification"** for a copy of the Map) as being under the Expressway or Arterial functional classifications. These Limited Access Highways should be protected under The Highway Protection Act.

The 1986 Highway Classification Study has shown that accident rates (see **Figure 4 on page 12** and **Figure 5 on page 13**) are substantially less where access controls are enforced. To achieve the maximum service life of the road facility and the servicability of adjacent land, the access spacings given in **Table 1 - Characteristics of Rural Highways** (see page 14) must be strictly adhered to. Only under exceptional geometric constraints, most unusual development situations or very difficult geographical conditions should consideration be given to reducing the spacing of accesses.

The desirable and minimum spacing for farm accesses shown in **Table 1** was based on

the consideration of a number of factors (ie; current practice, the pattern of land tenure in the Province, and the operating speed on the various classes of highway). It can be seen that where the primary function of a highway is to service land (ie; Collector types B and C), access control is more relaxed. In these situations, the spacing of accesses should be based on good engineering judgement taking into account factors such as existing and proposed development, terrain, and visibility.

Figure 2

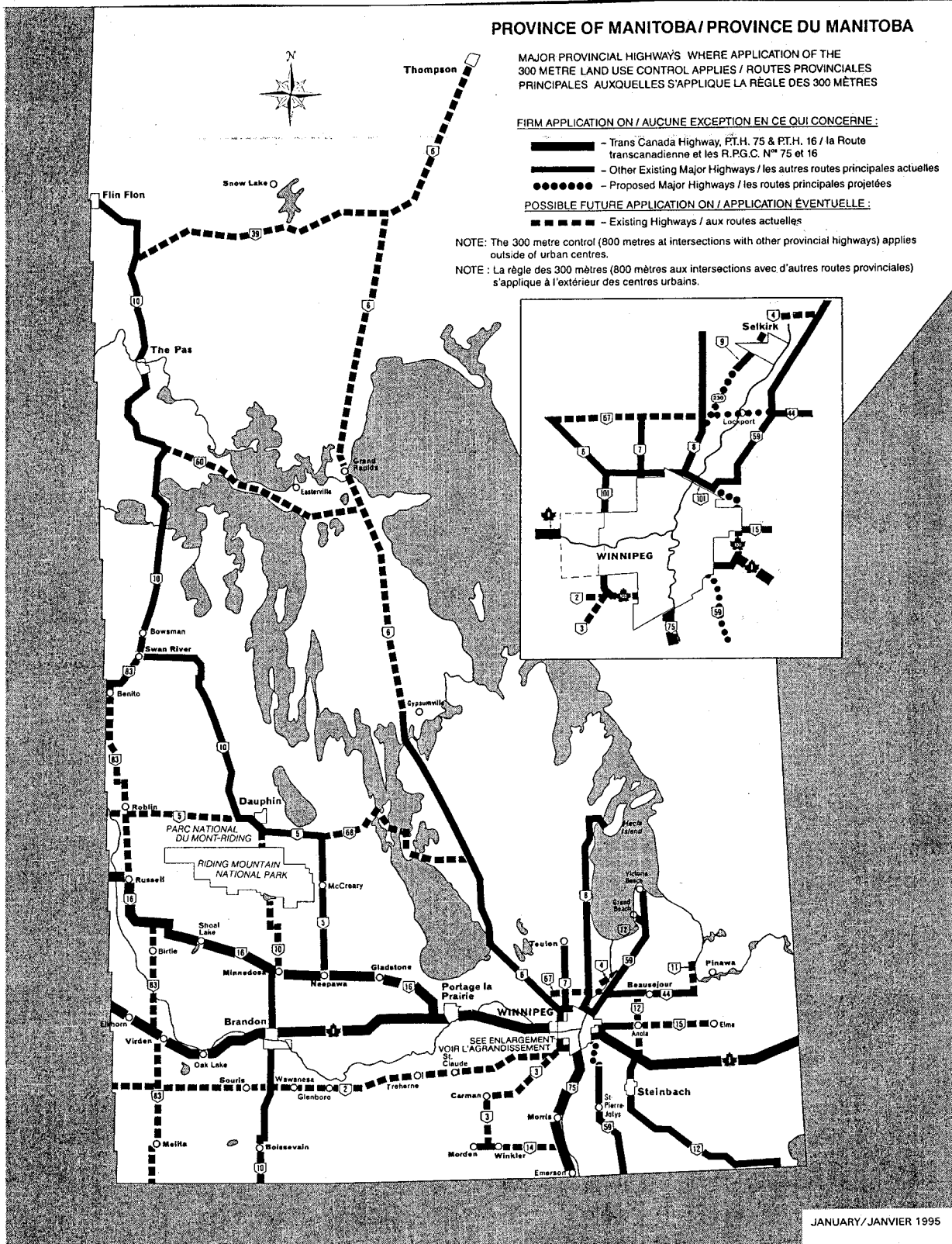


Figure 3

Highway Classifications & Land Use

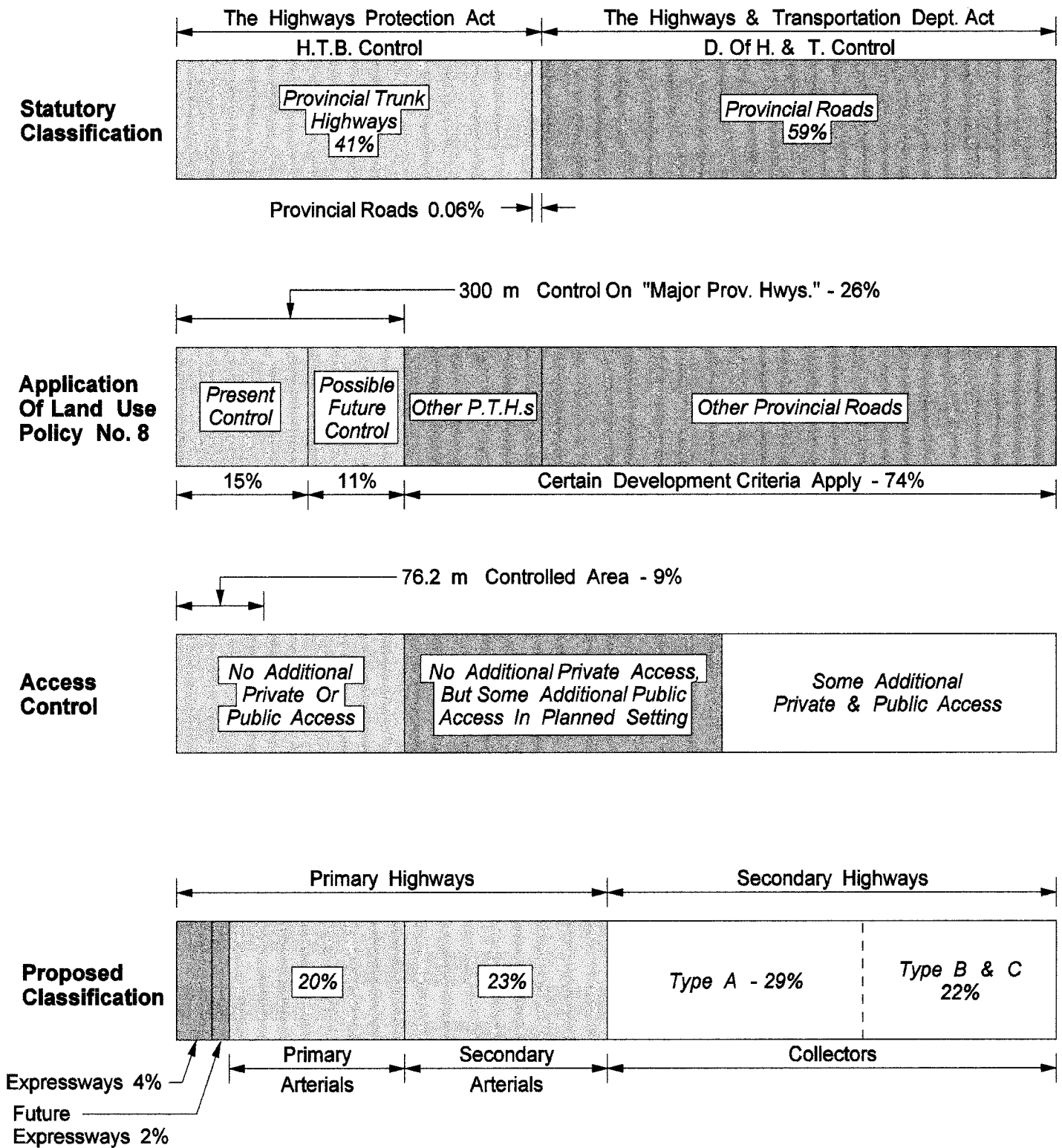
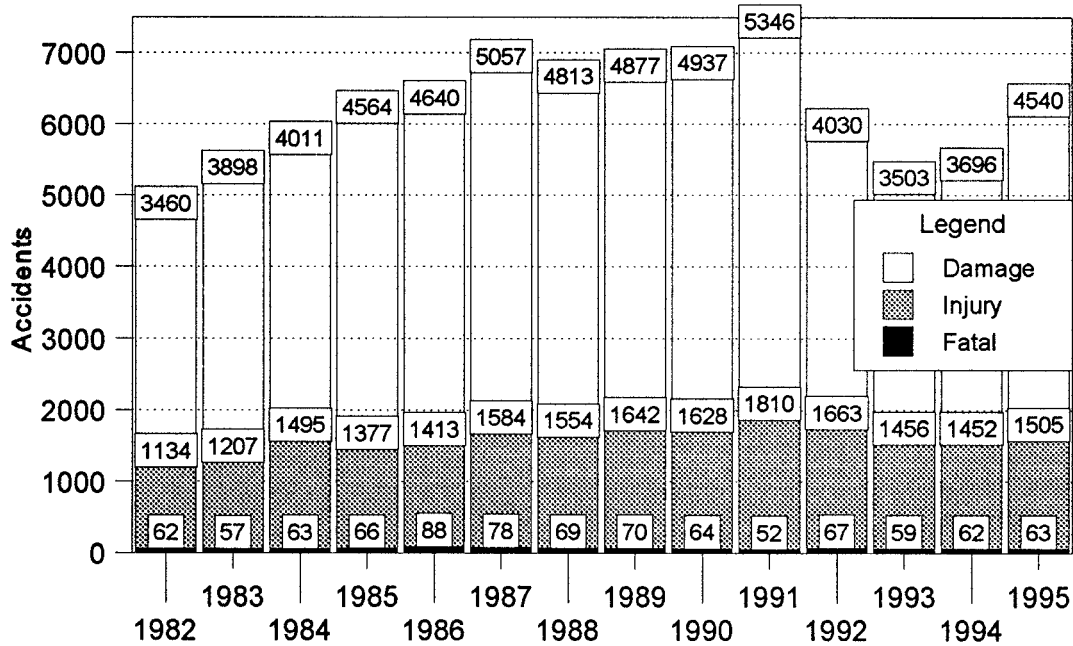


Figure 4

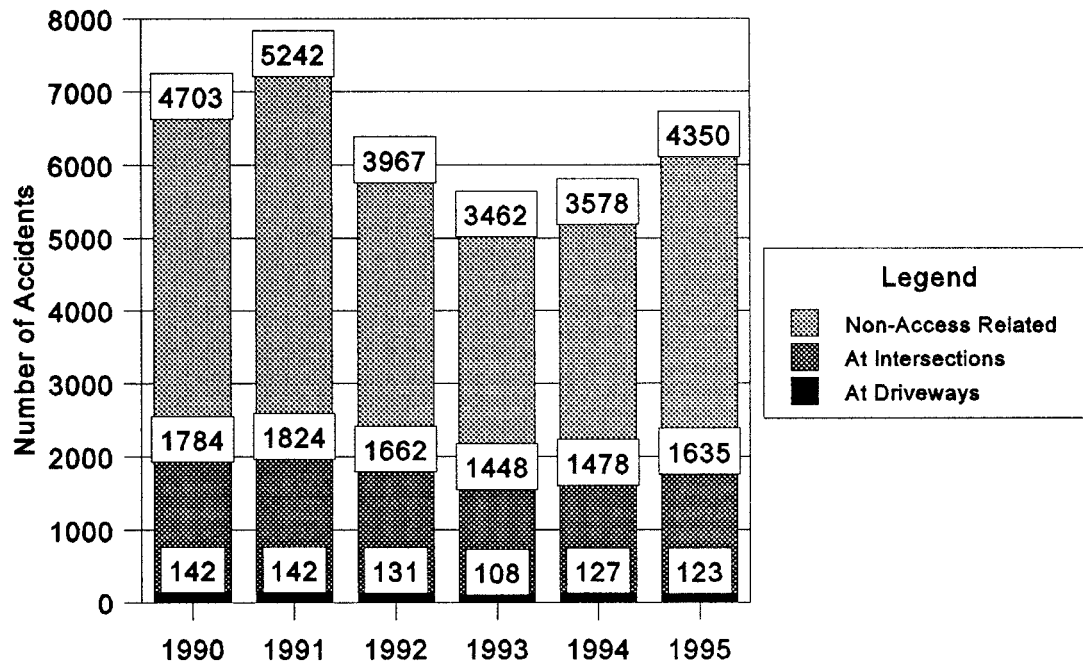
Accidents by Severity (1982 to 1995)



- Notes:**
- (1) The decrease in collisions as of 1992 is attributed to the increase from \$500 to \$1000 as the limit for reportable collisions.
 - (2) The historical accident data quoted is based from on record officially reported collisions.

Figure 5

Access Related Accidents (1990 to 1995)



- Notes:**
- (1) The decrease in collisions as of 1992 is attributed to the increase from \$500 to \$1000 as the limit for reportable collisions.
 - (2) The historical accident data quoted is based from on record officially reported collisions.

Table 1

CHARACTERISTICS OF RURAL HIGHWAYS

	COLLECTORS		ARTERIALS		EXPRESSWAYS	
	TYPES "B" & "C"	TYPE "A"	SECONDARY	PRIMARY	STAGE 1	STAGE 2
TRAFFIC SERVICE	Traffic Movement Secondary Function	Traffic Movement and Land Access Both of Equal Importance	Traffic Movement Primary Function	Optimum Mobility	Optimum Mobility	Optimum Mobility
LAND SERVICE	Land Access Primary Function		Land Access Secondary Consideration		Access to Selected Municipal Roads	No Access
CHARACTERISTICS OF TRAFFIC FLOW	Interrupted Flow	Interrupted Flow	Uninterrupted Flows Except at Signals		Uninterrupted Flows Except at Signals	Free Flow
CONNECTS MAJOR CENTRES OF POPULATION	Less than 500	500 - 1,000	1,000 - 10,000	Over 10,000		Over 10,000
ASSUMED AVERAGE RUNNING SPEED (km/h)	50 - 80	60 - 90	70 - 90	80 - 110		90 - 110
VEHICLE TYPE	Mostly Cars, Light to Medium Trucks, Occasional Heavy Trucks	Mostly Cars with All Types of Trucks	Mostly All Types of Vehicles up to 15% Trucks	Mostly All Types of Vehicles up to 20% Trucks	All Types with up to 30% Trucks	
CONNECTS TO	Expressways Arterials Collectors and Locals	All Classes	All Classes	All Classes	All Classes	All Classes Except Locals
MINIMUM SPACING OF FARM ACCESSES		80 - 300 m	300 m	400 m		
DESIRABLE SPACING OF FARM ACCESSES		200 - 600 m	600 m	800 m	No Direct Approach	No Approach
TRAFFIC ENTERING & LEAVING ACCESS	Under 50 ADT	Direct Access	Direct Access		No Direct Access,	
	50 - 500 ADT	Direct Access	Service Road / Turn Lanes		Access Via	
	Over 500 ADT	Direct Access / Turning Lanes	Service Road / Turn Lanes		Service Road	

TRANSPORTATION PLANNING POLICY : TP 2 / 98

**BASIC DESIGN AND CROSS-SECTION
STANDARDS**

**BACKGROUND / REFERENCE
MATERIAL**

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GENERAL INTRODUCTION

INTRODUCTORY NOTE: For more detailed information on the background, methodology, and reasoning behind the development of Transportation Planning Policy: TP 2 / 98 (Basic Design and Cross-section Standards) refer to the Transportation Systems Planning & Development Branch's "*Basic Design and Cross-section Standards - July 1997 Report.*"

Design Standards

The "Basic Design Standards" recommended in the 1986 Manitoba Highways Classification Study were based upon 20 year projected traffic volumes that took highway function into account. This concept has served well. However, revisions to these standards are required due to changing vehicle and road construction technology, aging population, global environmental concerns, anticipated service to land adjacent to highway corridors and fiscal restraints.

Manitoba has unique characteristics (i.e., very flat terrain in the south, permafrost conditions in the north, very sparse population in rural areas and very large concentrations of population in and around Winnipeg). Large areas of farmland abutting highways in the south and extreme variations in seasonal conditions also require special consideration in design standards. Current economic constraints and a departmental mandate to provide, where justified, paved shoulders, also necessitated a review of the warrants and cross-section standards for each class of highway.

This report deals with basic design standards that are applicable for new construction and major reconstruction projects. The review undertaken has reassessed design speeds, traffic warrants for each cross-section, shoulder width, paving and edge treatments, basic right of way requirements and bridge widths. It was felt that economies also could be accomplished by the introduction of "Rehabilitation Standards" that would rehabilitate a road close to its original constructed state without compromising road safety. The "Rehabilitation Standards" will be the subject of a separate report.

Design Speed

The design speed of a road is a value selected on the basis of highway functional classification, terrain, natural environment, roadside development, and anticipated traffic characteristics. The design speed affects the quality of service, safety, cost and the environmental impact of the facility. Once the road is constructed, the design speed is a permanent feature which cannot be altered without extensive reconstruction. Therefore, the selected design speed should be as high as practical in the interests of safety and service and compatible with terrain, roadside development and construction cost.

Some authorities relate posted speed to design speed. A value of 10 km / h less than design speed is also a common practice. While this may be a valid means of selecting posted speed, assuming the design speed is well chosen, the reverse should be avoided. It is therefore necessary for the design speed to be based on the function of the highway and on prevailing factors, not on posted speed.

In the past, posted speed limits were lowered as an energy conservation measure. This situation has changed due to more efficient vehicles. The Province also has come under pressure to raise speed limits on primary highways. Posted speed limits may be changed after a road is built. Adherence to speed limits tends to be related to the urgency of a drivers' business and the quality of enforcement, variables which are beyond the control of the design engineer.

On classifying the road, the design speed selected is usually a reflection of terrain, damage to natural environment and cost. Normally this selection is done by posing the question - What speed will a driver select under the most favourable road, traffic, climate and vehicular conditions? TAC suggests a maximum design speed of 140 km / h for its highest classifications. Presently used design speeds need to be examined and, if necessary, modified to suit modern road and vehicular requirements.

Traffic Warrant for Cross-section

The traffic warrant to twin a road and when to move from one cross-section standard to another needs to be examined due to changing size of trucks (length and weight) and also for fiscal restraints. The traffic warrants contained in the 1986 Basic Design Table were based on providing a Level of Service B for Expressway and Arterials and a Level of Service C for Collector highways.

The level of service (see **Schedule 1 - Definitions on page 13 and Table 5 - Level of Service Characteristics by Highway Type on page 14**) depends upon a number of factors including speed and travel time, traffic interruptions, freedom to manoeuvre, safety, driving comfort, convenience and operating cost. These factors are dependant upon traffic (cars and trucks), cross-section (lane width and shoulder width), operating speed, geometric (horizontal and vertical curves), passing sight distances and road side development.

DISCUSSION

DESIGN STANDARDS

Design standards are required to reflect the revised classification system in a practical manner and in a way that continues to ensure a high level of service and safety for the travelling public. They also should reflect the service aspect of each highway and its sensitivity to the environment in which it is located. With these principles in mind, revised basic standards were developed that allowed for slightly lower standards on Secondary Arterial and Collector routes and higher standards on Primary Arterials.

For level of service (See Schedule 1 - Definitions on page 13), there is a consensus among engineering staff that Expressways and Arterials should be designed to provide a minimum level of service 'B'. This is largely because these routes serve long distance traffic with trucks carrying goods to far markets. To this end, they should generally provide a running speed of 90 km / h. Whereas, Collector routes should provide a minimum level of service 'C'. These levels of service are recommended for roads in rural areas that do not fall under the Parkway or Suburban Highway special design categories. However, before highway upgrades are considered, a thorough engineering and economic justification that takes into account road user benefits / costs is required.

The proposed "**Basic Design Standards for Provincial Highways (For New & Major Reconstruction)**" given in **Table 1 to Transportation Planning Policy TP 2 / 98**, represent a combination and rationalization of the current standards for PTHs and PRs.

Design Speed

The proposed Basic Design Standards for Provincial Highways include previously adopted design speeds (See Table 2 - "**Basic Design Speed Standards for Rural Provincial Highways**" on page 4). These speeds are still justified as some speed limits on Arterial routes have been increased from 90 km / h to 100 km / h. Also, it is noted that actual operating speeds on 2-lane highways are close to 100 km / h in southern Manitoba and 110 km / h in remote areas. Actual operating speed on 4-lane divided highways (with depressed median) is close to 110 km / h. For low volume Collector highways, the design speed remains 100 km / h (flat terrain), 90 km / h (rolling terrain) and 80 km / h (rugged terrain), to reduce environmental impact (e.g., minimize land fragmentation at curves) and construction costs. **Specific speed related traffic operation definitions are given in Schedule 1 - Definitions on page 13.**

It is generally recommended that unless the construction costs and environmental impacts are great, highways be designed for the upper design speed in each range. It should be kept in mind that once the highway is constructed, the design speed is a permanent feature which cannot be altered without extensive reconstruction.

Based upon these design speeds and TAC geometric standards, appropriate values of alignment have been incorporated in the abovementioned **Table 1**. The only exception being the Trans-Canada Highway where the minimum recommended radius is 1100 -1200 m to enable longer trucks, trailers and trains to make use of this highway.

Table 2

The "Basic Design Speed Standards for Rural Provincial Highways" are as follows:

Highway Classification / 10 Year AADT	Terrain			
	All *	Flat	Rolling	Rugged
Expressway	130 km/h	-	-	-
Primary Arterial > 6000 AADT 1000 - 6000 AADT < 1000 AADT	130 km/h 120 km/h N/A	- - 120 km/h	- - 110 km/h	- - 110 km/h
Secondary Arterial > 6000 AADT 1000 - 6000 AADT 500 - 1000 AADT < 500 AADT	130 km/h N/A N/A N/A	- 120 km/h 120 km/h 110 km/h	- 110 km/h 110 km/h 100 km/h	- 110 km/h 100 km/h 90 km/h
Collector > 7000 AADT 1000 - 7000 AADT 300 - 1000 AADT < 300 AADT	120 km/h N/A N/A N/A	- 120 km/h 110 km/h 100 km/h	- 110 km/h 100 km/h 90 km/h	- 100 km/h 90 km/h 80 km/h

* Design speeds may be lowered to minimize significant damage to the environment and / or to alleviate high construction costs.

Cross-section

Lane Width:

The recommended lane width of 3.7 m remains. Studies have shown that inadequate vehicle lateral clearance and edge of pavement clearance occurs on lanes less than 3.5 m wide when carrying even a moderate volume of mixed traffic. To provide a desirable clearance between trucks, a lane width of 3.7 m is required. In general, safety increases with wider lanes up to 3.7 m. A lane width greater than 3.7 m does not offer further increased safety. Additional safety is offered by incorporating shoulders in the cross-section.

Shoulder Width:

Most of the current shoulder widths (3.0 m, 2.5 m, and 2.0 m) are retained in the proposed standards. However, the projected traffic volume ranges to which they apply have been revised upwards or downwards depending on the functional classification. It should also be noted that the minimum shoulder width is now proposed at 1.0 m instead of 1.3 m. The gravel roadway width standards remain at 8 m and 8.4 m (for rolling terrain).

The relationship between the proposed and current standards in terms of the overall finished top width of the various classes of highway is shown in **Table 3 - Comparison of Finished Top Widths (see page 6)**. Proposed cross-section widths generally fall within the ranges specified by TAC. The top widths vary depending on the functional class and projected traffic volume on the highway facility throughout its length. The maximum shoulder width for a 2-lane Primary Arterial is 3.0 m, 2.5 m for a 2-lane Secondary Arterial and 2.0 m for a Collector. The 2.0 m ceiling on the shoulder width of a Collector still allows two-lane operation (2 x 3.7 m) past a 2.6 m wide vehicle parked on one shoulder, although some encroachment on the opposite shoulder would likely result.

A major change in the design standards is the inclusion of partially / fully paved shoulders. The paved shoulder study undertaken by the Virginia Transportation Research Council concluded that the provision of a 0.8 m paved shoulder increased the pavement life of bituminous pavement by 15%. Using these results, an in-house assessment came to the following conclusions:

Partially Paved Shoulders:

- The initial cost increase to accommodate a 0.8 m paved shoulder was 2.5 % for a new pavement versus 12.6 % to retrofit for an overlay.
- The maintenance cost saving is \$160.00 per lane km.
- Accidents are reduced by 1.6% as a result of paving 0.8 m of shoulder.
- The threshold AADT for the economic justification of partially paved shoulders is 287 v/d for an overlay and 109 v/d for a new road.

Fully Paved Shoulders:

- The cost increase to accommodate fully paved shoulder was 22.8 % for a new road versus 55.8 % to retrofit for an overlay.
- Maintenance saving is \$160.00 per lane km.
- Accidents are reduced by 1.6 %.
- The threshold AADT for the economic justification is 1390 for a new road and 1452 for an overlay.

In addition, partially or fully paved shoulders also offer the following advantages over gravel shoulders:

- increased driver comfort
- improved passing vehicle safety
- reduced shoulder-related accidents
- reduced shoulder maintenance
- added lateral support, leading to increased pavement life
- added allowance for bicycles, pedestrians.

Table 3

COMPARISON OF FINISHED TOP WIDTHS

RURAL CLASSIFICATION	TAC	MANITOBA		
		PREVIOUS (1986)	CURRENT	PROPOSED
PRIMARY ARTERIAL	12.0 - 13.4	10.4 - 13.4	12.4 - 13.4	12.4 - 13.4
SECONDARY ARTERIAL	N/A (NOTES 1 & 2)	10.4 - 13.4	10.0 - 12.4	9.4 - 12.4
COLLECTOR	9.0 - 13.4	7.4 - 13.4	10.0 - 11.4	9.4 - 11.4
LOCAL	8.0 - 8.6	---	---	---

Dimensions are shown in metres for 2 lane paved roads

NOTES:

1. TAC DOES NOT HAVE A SECONDARY ARTERIAL CLASSIFICATION.
2. TAC CROSS-SECTIONS ARE LARGELY BASED ON ONTARIO STANDARDS. UNDER THESE STANDARDS, SOME OF THEIR UPPER LEVEL COLLECTOR ROUTES COULD BE COMPARED TO MANITOBA'S SECONDARY ARTERIAL CLASSIFICATION.

Based on the above and internal discussions with technical staff within the Department, fully paved shoulders are recommended for two-lane National Highway System Routes and two-lane Primary Arterials with an existing AADT greater than 3500 v/d.

The shoulder paving standard for 4-lane divided highways (Expressways, Arterials and Collectors) is recommended as follows:

Bituminous Surface:

outside: 0.8 m bituminous paved strip
inside: fully paved bituminous

Concrete Surface:

outside: 0.6 m concrete strip
inside: fully paved bituminous

Partial shoulder paving is recommended for Primary Arterials with an existing AADT of 500 to 3500 and other 2-lane highways with an AADT greater than 1000. For bituminous surface highways, the recommended standard is a 0.8 m paved strip. For concrete highways, the proposed standard is a 0.6 m concrete paved strip.

The standard for all other highways will be gravel shoulders. Consideration will be given for full width paved shoulders under the following circumstances:

- 1) roads having posted speeds equal to or less than 50 km / h;
- 2) roads having posted speeds of 50 - 70 km / h and where local conditions and/or developments dictate (e.g., shoulders serve cyclists/pedestrians);
- 3) route continuity;
- 4) where soil conditions dictate that the shoulder be paved.

The Department's present practice of paving shoulders, based on the above discussions, are shown in **Table 4 - "Paved Shoulder Criteria and Design Standards (Resurfacing of Existing Highways with Paved Shoulders)"** on page 9.

Shoulder Edge Treatment:

Shoulder edge treatment is recommended to provide for a smooth change in cross fall from shoulder slope to side slope. A gravel shoulder edge treatment and two paved shoulder edge treatment options are detailed in **Figure 1 "Shoulder Edge Treatment"** (see page 10). The two paved shoulder edge

treatment options are both acceptable.

The advantages derived from Shoulder Edge Treatment include:

- increased lateral support;
- enhanced vehicle safety;
- no pavement edge drop off with fully paved shoulder;
- accommodates future overlay with minimal or no grade widening; and
- ease in construction for fully paved shoulder.

Basic Cross-sections

The basic cross-sections relating to the proposed standards are shown in **Figures BCS 1 - 9 attached to Transportation Planning Policy TP 2 / 98**. They are very similar to the basic cross-sections previously used by the Department, with the following exceptions:

Basic Cross-section 1 (4-Lane Divided)

All provincial highways would have a minimum 0.8 m partially paved shoulder. The left shoulder has been reduced for an Expressway from 2.0 m to 1.5 m and from 1.5 m to 1.2 m for an Arterial Route. In both cases the shoulder should be fully surface treated.

The warrants for consideration of four-laning an Arterial and Collector highways have been respectively raised to 6000 and 7000 vehicles per day (v/d). These warrants are only a guide as level of service and appropriate engineering and economic justifications that take into consideration road user costs / benefits **must** be applied to justify the four-laning of a highway.

Basic Cross-sections 2 and 2G (2-Lane)

National Highway System routes, Primary Arterials with an existing AADT greater than 3500 v/d, and roads where shoulders serve cyclists/other road users, would have fully paved shoulders.

Basic Cross-sections 3 and 4 (2-Lane)

A partially paved shoulder is provided for these cross-sections. However, when the existing AADT for a Primary Arterial route is less than 500 v/d and less than a 1000 v/d for Secondary Arterial and Collector roads, the full shoulder width should be gravel. In cases where the road serves other road users, the provision of fully paved shoulders should be considered.

Table 4

PAVED SHOULDER CRITERIA AND DESIGN STANDARDS

Resurfacing of Existing Highways with Paved Shoulders

<u>Bituminous Surface</u> Preserve existing paved shoulder subject to geometric standards	<u>Concrete</u> Preserve existing paved shoulder subject to geometric standards
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New Construction and Reconstruction

No. of Lanes	Functional Classification/ Existing AADT	Bituminous Surface	Concrete Surface
4-Lane Divided	Expressway Arterial Collector	outside: 0.8 m bituminous paved strip inside: fully paved bituminous	outside: 0.6 m concrete strip inside: fully paved bituminous
2-Lane	- National Highway System - Primary Arterials with AADT >3500	Full width paved	Two 4.3 m concrete lanes (3.7 m lane and 0.6 m concrete strip, plus bituminous shoulder)
	Primary Arterials with AADT > 500 Other 2-lane highways with AADT >1000	0.8 m paved strip	0.6 m concrete paved strip
	All others	gravel	gravel

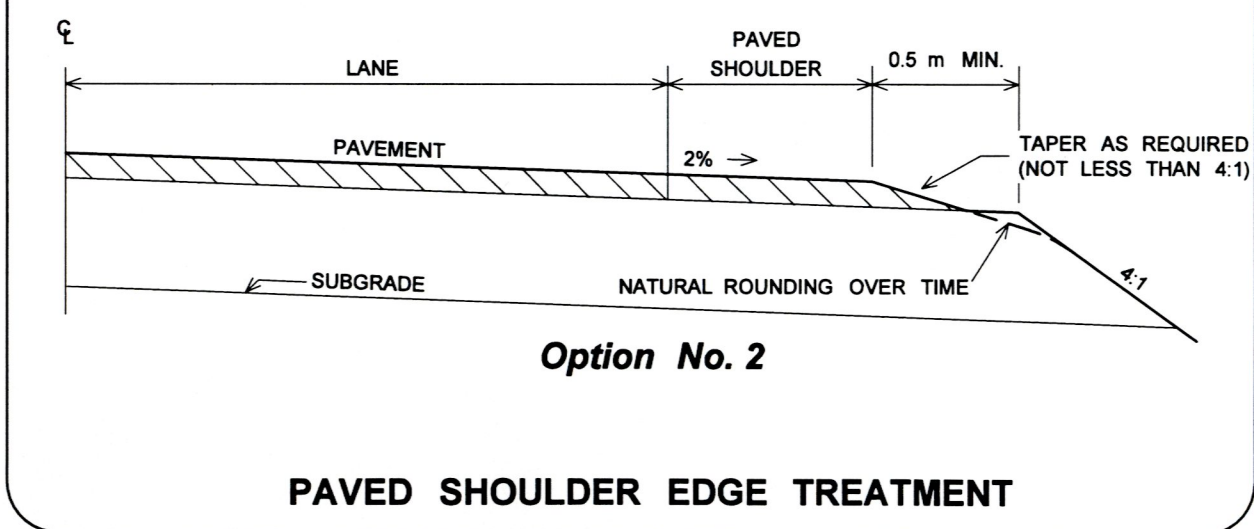
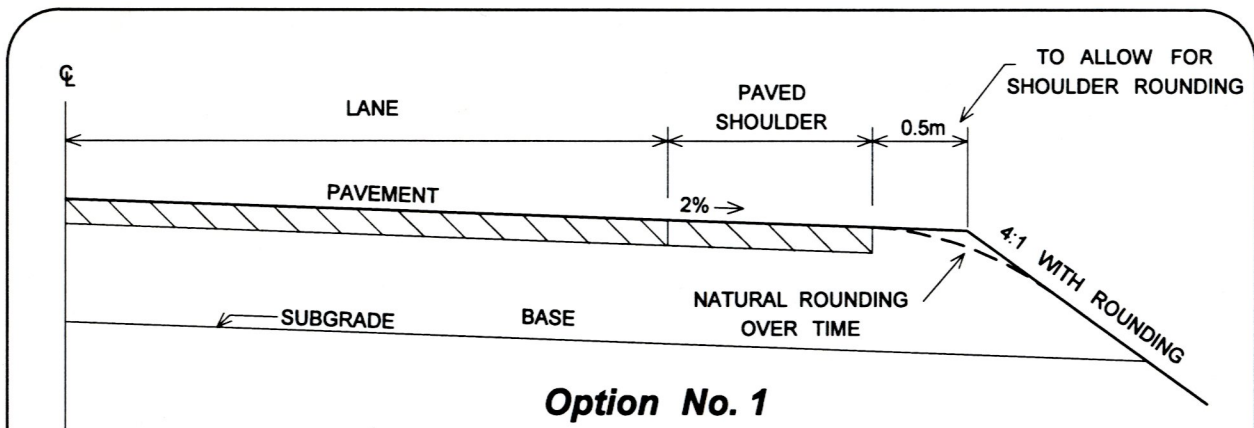
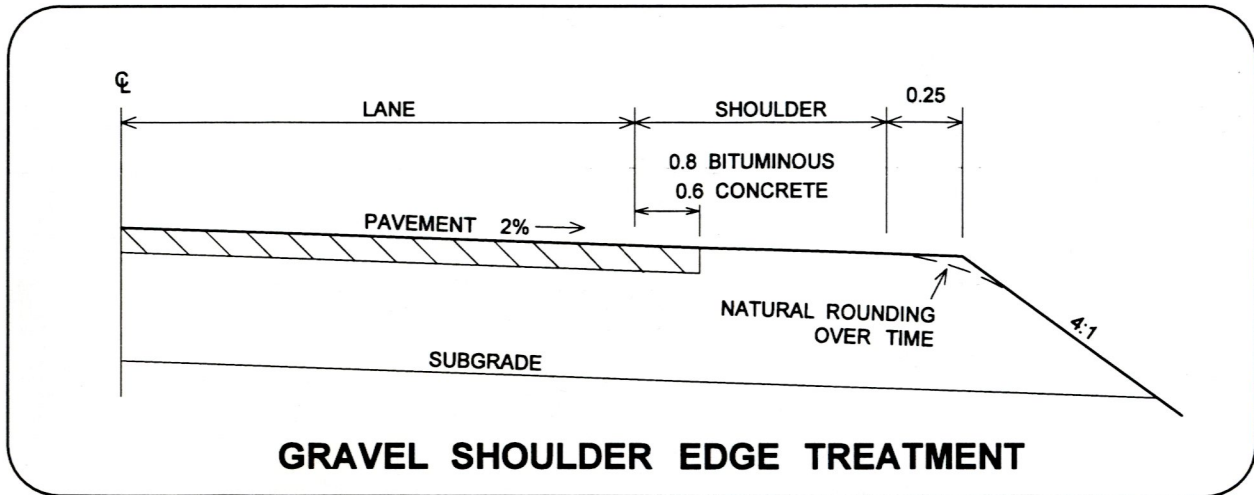
Consideration be given for full width paved / hard surfaced shoulders for roads having:

- 1) Posted speed ≤ 50 km/h
- 2) Posted speed of 50-70 km/h and local conditions dictate (Eg. pedestrians, cyclists).
- 3) Route continuity

New Asphalt Treated Highway

AST Gravel-based Highway	Full width seal (for roads whose final surface is AST)
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FIGURE 1



NOTE: SUBGRADE WIDTH = 2 x [LANE WIDTH + SHOULDER WIDTH + 0.5 + 4 x (BASE + PAVEMENT DEPTH)]

Basic Cross-Section 5 (2-Lane)

This cross-section has been narrowed from 10.0 m to 9.4 m. The cross-section should be fully paved / surface treated.

Basic Cross-Sections 5.S1 and 5.S2 (2-Lane)

Stage construction is recommended for Secondary Arterials where the projected 10 yr. AADT is less than 300 v/d and for Collectors when the projected 10-year AADT is in the 300 v/d range.

Basic Cross-Section 6 (2-Lane)

The top widths for all gravel roads remain as 8.0 m (8.4 m in rolling terrain).

An in-house study showed that the warrants to pave a road should remain at 300 v/d (20 yr. AADT). Paving highways with traffic volumes less than 200 v/d may be warranted due to special circumstances such as soil conditions, adjacent developments, large volumes of truck traffic or the need to maintain the continuity of a route surface.

As previously mentioned, it is also recommended that roads that warrant paving should be constructed in stages according to **Basic Cross-sections 5.S1 and 5.S2** where it is anticipated that it will be 5 to 10 years before they are paved. With stage construction - the earth, ditches, subgrade and berms are built to accommodate eventual surfacing. However, the travelled roadway is built with gravel to between a 8.0 m - 8.4 m width. Under stage construction - the rock and ditches would be constructed at the final location so that the subgrade can be widened at a later stage to accommodate surfacing in a manner that will not affect the ditches. Provision of the 8.0 m gravel top in both types of stage construction (as compared with something wider) results in considerable savings in maintenance costs prior to the highway being hard surfaced.

Right-of-Way

The right-of-way widths previously adopted following the 1986 Manitoba Highways Classification Study (See Table 1 - Basic Design Standards for Provincial Highways - March 1986 on page 16 of the Study Report) have been increased somewhat for low volume roads to minimize the future negative effect on adjacent lands. The minimum right-of-way width is now 45 to 50 m for roads located in a rugged area. The right-of-way widths apply to the normal type of highway construction using side borrow. Where the sources of subgrade materials are from borrow beyond the right-of-way, consideration should be given to reducing these widths, in particular, where the highway is crossing prime agricultural land, built-up areas or environmentally sensitive areas.

In the case of multi-lane divided highways, acquisition of right-of-way can be reduced by using median

widths in the lower end of the range (but not compromising safety) and through utilizing borrow pits. These alternatives should be given serious consideration when prime agricultural or environmentally sensitive land is affected.

Pavement Design

It is recommended that for pavement design, all Expressway and Arterial routes be designed and constructed to carry RTAC loading and to withstand single axle loads of 9 100 kg. Unless justified otherwise, all other provincial highways should be designed and constructed to carry single axle loads of 8 200 kg. It is further recommended that all new roads be designed to carry either RTAC or B1 loading standards and that the present practice of designing A1 roads be dropped.

Bridge Design Standards

Bridge Width:

The bridge widths for all classes of provincial routes remain the same, except for the minimum bridge width which is recommended to be increased from 8.4 m to 9.6 m to accommodate larger trucks and future growth (life of structure is 50 years plus).

Bridge Loading:

All new bridges are to be designed to carry HSS 25 or HS 30 lane loadings.

SCHEDULE 1

DEFINITIONS**LEVEL OF SERVICE:**

A rating system consisting of six levels of services are used for capacity analysis (see **Table 5 - Level of Service Characteristics by Highway Type on page 14**). Level of Service "A" represents the best operating conditions, and level of service "F" the least favourable conditions. Level of service "A" represents free flow, with individual users virtually unaffected by the presence of other users in the traffic stream. Level of service "B" is the range of stable flow, with the presence of other users in the traffic stream beginning to affect the freedom to manoeuvres. Level of service "C" is the range of stable flow, but operations of individual users, speeds, and freedom to manoeuvre are significantly affected by others in the traffic stream. The general level of comfort and convenience declines noticeably at this level. Level of service "D" represents high-density, but stable, flow. Speed, freedom to manoeuvre, level of comfort, and convenience are severely restricted. Small increases in traffic flow will generally cause operational problems. Level of service "E" represents operations at or near the capacity level. Freedom to manoeuvre and comfort and convenience levels are extremely poor. Operations at this level are usually unstable because small increases in flow or minor perturbations within the traffic stream will cause breakdowns. Level of service "F" is used to define forced or breakdown flow. Operations are characterized by stop-and-go waves and are extremely unstable.

TRAFFIC OPERATIONS DEFINITIONS:***Design Speed:***

A speed selected for purposes of design and correlations of those features of a highway, such as curvature, superelevation and sight distance, upon which the safe operation of vehicles is dependent.

Operating Speed:

The highest overall speed at which a driver can travel on a given highway under favourable conditions without at any time exceeding the safe speed as determined by the design speed on a section by section basis.

Traffic Operations Definitions Source: Chapter G - RTAC Manual of Geometric Design Standards for Canadian Roads (1986 Metric Edition)

Table 5
Level of Service Characteristics by Highway Type

Level Service	Controlled Access Highways	Multilane Rural without Access Control	Two Lanes	Urban and Suburban Arterials
A	Free flow. Average travel speeds at or greater than 60 mph. Service flow rate of 700 passenger cars per hour per lane.	Average travel speed 57 mph or greater. Under ideal conditions, flow rate is limited to 700 passenger cars per lane per hour or 36 percent capacity.	Average speeds of 50 mph or higher. Most passing maneuvers can be made with little or no delay. Under ideal conditions, a service flow rate of 420 passenger car per hour, total two way, can be achieved.	Average travel speed of about 90 percent of free flow speed. Stopped delay at signalized intersections is minimal.
B	Reasonably free flow conditions. Average travel speed at greater than 57 mph. Service flow rate not greater than 1,100 passenger cars per hour per lane.	Reasonably free flow. Volume at which actions of preceding vehicle will have some influence on following vehicles. Flow rate will not exceed 54 percent of capacity of 1,100 passenger vehicles per lane per hour at a 53 mph average travel speed under ideal conditions.	Average travel speeds of 55 mph or higher. Flow rates may reach 27 percent of capacity with continuous passing sight distance. Flow rates of 750 passenger cars per hour, total two-way, can be carried out under ideal conditions.	Average travel speeds drop due to intersection delay and inter-vehicular conflicts, but remain at 70 percent of free flow speed. Delay is not unreasonable.
C	Operation stable, but becoming most critical. Average travel speed of 54 mph, service flow at 77 percent of capacity or not more than flow rate of 1,550 passenger cars per hour per lane.	Stable flow to a flow rate not exceeding 71 percent of capacity of 1,400 passenger cars per lane per hour, under ideal conditions, maintaining at least a 50 mph average travel speed.	Flow still stable. Average travel speeds of 52 mph or above with total flow rate under ideal conditions equal to 43 percent of capacity with continuous passing sight distance of 1,200 passenger cars per hour total two-way.	Stable operations. Longer queues at signals result in average travel speeds of about 50 percent of free flow speeds. Motorists will experience appreciable tension.
D	Lower speed range of stable flow. Operation approaches instability and is susceptible to changing conditions. Average travel speeds approx. 46 mph. Service flow rate at 93 percent of capacity. Flow rate cannot exceed 1,850 passenger cars per hour per lane.	Approaching unstable flow at flow rates up to 87 percent of capacity or 1,750 passenger cars per hour at an average travel speed of about 40 mph. under ideal conditions.	Approaching unstable flow. Average travel speeds approx. 50 mph. Flow rates, two-direction, at 64 percent of capacity with continuous passing opportunity, or 1,800 passenger cars per hour total two way under ideal conditions.	Approaching unstable. flow. Average travel speeds down to 40 percent of free flow speed. Delays at intersections may become extensive.
E	Unstable flow. Average travel speeds of 30-35 mph. Flow rate at capacity or 2,000 passenger cars per hour per lane under ideal conditions. Traffic stream cannot dissipate even minor disruptions. Any incident may produce a serious breakdown.	Flow at 100 percent capacity or 2,000 passengers cars per lane per hour under ideal conditions. Average travel speeds of about 30 mph.	Average travel speeds in neighbourhood of 45 mph. Flow rate under ideal conditions, total two-way, equal to 2,800 passenger cars per hour. Level E may never be attained. Operations may go directly from Level D to Level F.	Average travel speeds of 33 percent of free flow speed. Unstable flow. Continuous backup on approaches to intersections.

Level Service	Controlled Access Highways	Multilane Rural without Access Control	Two Lanes	Urban and Suburban Arterials
F	Forced flow. Freeway acts as a storage for vehicles backed up from downstream bottleneck. Average travel speeds range from 30 mph to stop-and-go operation.	Forced flow, congested conditions with widely varying volume characteristics. Average travel speeds of less than 30 mph.	Forced, congested flow with unpredictable characteristics. Operating speeds less than 45 mph.	Average travel speed between 25 and 33 percent of free flow speed. Vehicular backups, and high approach delays at signalized intersections.

**** Source:** Table 11-5 AASHTO Geometric Design of Highways and Streets Design Controls and Criteria (1990)