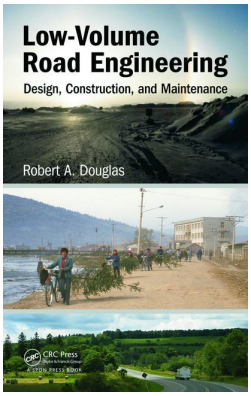

Low-Volume Road Engineering: Design, Construction, and Maintenance

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Road classification

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Chapter 3

Road classification

3.1 INTRODUCTION

The entry point to road geometric design is the classification of the road. Before covering geometric design, road classification will be discussed.

There are probably thousands of classification systems. Biologists deal with the taxonomy of animals and plants. Geologists classify rocks. Geotechnical engineers classify soils. Soil scientists do too, but with different systems. Sports organizations sort teams into leagues. And so on.

There are a number of common points to be made about classification systems:

- In every case, there is a sorting of the population into groups of individuals with common characteristics.
- There is some description of those characteristics, either explicit or implied.
- There is the intention to convey a common picture of the characteristics of an individual in one of the groups to everyone familiar with the classification system.
- Predictions of the behavior of an individual can be made based on the classification of that item.

The last two points are the most important. The reasons to classify anything are to have a short-hand description, which provides a clear picture of what that thing is like, and to be able to predict how it will behave. The same is true for the classification of roads.

Functional classification systems exist for roads in developed countries, with classes such as interstate, primary, collector, and local. While LVR usually fall into the lowest one or two classes in such systems in developed countries, because of the preponderance of two- and three-wheeled vehicles, bicycles, nonmotorized traffic and pedestrian traffic, even primary roads may be classified as LVR in terms of an ADT measure that only accounts for motor vehicles.

The following sections outline the road classification systems for LVR prevalent in the United States, Canada, the United Kingdom, South Africa, and Australia.

3.2 THE U.S. SYSTEM

The U.S. system is provided in the *Guidelines for Geometric Design of Very Low-Volume Local Roads* [3.1] known as the "Little Green Book." Rural and urban roads with AADT less than 400 veh/day are classified according to function as shown in Table 3.1.

Table 3.1 AASHTO road classifications

Classification	*Description*
Rural roads	
Major access roads	Serve a dual function: access to abutting land and connecting service to other roads
Minor access roads	Almost exclusively used for access to abutting land—roads are typically short—may be dead ends—speeds are low
Industrial/commercial access roads	Provide access to factories or commercial outlets—high proportion of truck traffic—roads are typically short and dead ended
Agricultural access roads	Provide access to fields—traffic often consists of large, heavy, and or slow agricultural equipment
Recreational and scenic roads	Serve specialist land uses such as parks and campsites—roads have low truck traffic but typically do cater to large, slow recreational vehicles
Resource recovery roads	Serve mining or logging operations—traffic has a very high proportion of large, heavy resource industry trucks
Urban roads	
Major access streets	Serve a dual function: access to abutting land and connecting service to other roads—typically shorter than rural equivalents
Urban residential streets	Access to single and multiple family residences—large trucks are rare
Industrial/commercial streets	Serve developments that generate a substantial number of large and/or heavy trucks—typical function is to provide connection between a factory and highway

Source: AASHTO, *Guidelines for Geometric Design of Very Low-Volume Local Roads (AADT < 400)*, American Association of State Highway and Transportation Officials (AASHTO), Washington, DC, 2001.

3.3 THE CANADIAN SYSTEM

As shown in Table 3.2, in the Canadian system [3.2], roads are simply designated as "LVR" with the design speed appended. Eight designations are permitted. The table indicates the recommended limits for gradients, sight distances, superelevation (banking), and curve radii.

3.4 THE UK SYSTEM

Overseas Roadnote 8 [3.3] presents a system of classification for all roads. The access categories pertain to volumes less than 400 veh/day. Table 3.3 shows the road classifications, traffic volumes, surface type, dimensions, gradients, and design speeds.

3.5 THE SOUTH AFRICAN SYSTEM

An excellent compilation of road classifications is provided in the South African Road Classification and Access Management Manual [3.4]. The manual notes the prevalence of six-class systems. The publication does not identify low-volume roads specifically, however, these would generally fall into Rural Classes 4 and 5, Collectors and Local Roads, respectively, when classed according to function (Table 3.4).

3.6 THE AUSTRALIAN SYSTEM

Giummarra [3.5] examined road classification systems across Australia and abroad, and found that most rural LVR fall into Class 5 of the systems in place in Australia. For LVR, he recommended subdivision of Class 5 into five more classes, as shown in Table 3.5.

Table 3.2 TAC low-volume road classifications

Classification	*Design speed (km/h)*	*Maximum gradient (%)*	*Minimum stopping sight distance[a] (m)*	*Maximum superelevation (m/m)*	*Minimum radius of curve (m)*
LVR30	30	11–16	30	0.08	30
LVR40	40	11–15	45	0.08	50
LVR50	50	10–14	65	0.08	80
LVR60	60	10–13	85	0.08	120
LVR70	70	9–12	110	0.08	170
LVR80	80	8–10	140	0.08	230
LVR90	90	7–9	170	0.08	300
LVR100	100	6–8	200	0.08	390

Source: RTAC, *Manual of Geometric Design Standards for Canadian Roads*, Roads and Transportation Association of Canada (RTAC, now TAC), Ottawa, Ontario, Canada, 1986.

[a] Applicable to two-lane roads and one-lane one-way roads.

Table 3.3 Overseas Road Note 6 road classifications

				Width			*Design speed by terrain*		
Road function	*Design class*	*Traffic volume (veh/day)*	*Surface type*	*Running surface (m)*	*Shoulder (m)*	*Maximum gradient (%)*	*Mount (km/h)*	*Rolling (km/h)*	*Level (km/h)*
Access	D	100–400	Paved/unpaved	5.0	1.0[a]	10	50	60	70
	E	20–100	Paved/unpaved	3.0	1.5[a]	15	40	50	60
	F	<20	Paved/unpaved	2.5–3.0	Passing places	15–20	n/a	n/a	n/a

Source: TRL, *Overseas Road Note 6*, Overseas Unit, Transport and Road Research Laboratory (TRRL, now TRL), Crowthorne, U.K., 1988.

[a] For unpaved roads where the running surface is gravelled, the shoulder would not normally be gravelled, however, for Class D roads, consideration should be given to gravelling shoulders if shoulder damage occurs.

Table 3.4 South African road classifications (COTO [3.4])

Rural road class	*FHWA description*	*Percentage of veh-km*	*Percentage of road length*
R1, R2	Principal arterials	30–55	2–4
R1, R2, R3	Principal plus minor arterials	45–75	6–12
R4	Collectors	20–35	20–25
R5	Local roads	5–20	65–75

Table 3.5 Proposed Australian road classifications

Road class	*Class type*	*AADT (veh/day)*	*Design speed (km/h)*	*Running surface width (m)*	*Description*
5A	Primary road	>100	50–80	7	Main traffic movement through a region
5B	Secondary road	50–100	30–70	5.5	Collects and distributes traffic from local areas
5C	Minor road	20–50	20–60	4	Links areas which are traffic generators to secondary or primary roads
5D	Access track or road	<20	<20–40	4	Provides access to low-use sites
5E	Rough track	<10	n/a	3	Primarily for four-wheel drive vehicles

Source: Giummarra, G., Road classifications, geometric designs and maintenance standards for low-volume roads. Research Report ARR354. ARRB Transport Research Ltd., Vermont South, Victoria, Australia, 2001. Used with permission of ARRB group Ltd.

3.7 A NOVEL SYSTEM

All of the systems described earlier are closed systems; there is a finite set of classifications into which any road must go. Sometimes the fit is not good.

In an open system devised by Paterson et al. [3.6], the important engineering characteristics of the road are directly embedded in its classification name. The road designations have the following fields:

Al axle loading: expressed as the maximum single axle load expected to occur over the life of the road (has an impact on the design of the road structure)
S speed: expressed as the *minimum* speed for the design vehicle which can be tolerated (a reflection of the maximum gradients allowed)
A availability: Y = year round

A = all weather (except during season of thaw and subsequent recovery)
W = winter only (i.e., only when frozen)
D = dry weather only
T traffic volume: number of equivalent single axle loads (ESAL) per day
L design life: the number of years until major rehabilitation or abandonment of the road

The system is called the AL-SAT-L system after its field names. In the system, a road classed for example as 100 kN—15 km/h—D—10 ESAL—1 would be one designed to carry a maximum axle loading of 100 kN/axle, with gradients flat enough that a speed of at least 15 km/h could be maintained. The road would be available for use during dry weather only, is designed to carry 10 ESAL/day, and would have an expected life of 1 year.

A completely open classification system results **from** taking the Al-SAT-L approach. Any road can be classed, and its relevant engineering characteristics can be conveyed by the classification designation. The system was designed specifically for logging roads, and although it could also be used for mining, oil sands, and oil and gas, it has never been implemented routinely.

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