

International Practice in Highway Access Management

A Primer



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A Primer

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Introduction

Transportation research and practice has spurred many advancements in recent years in the areas of roadway safety, operations, "completeness" (e.g., modal options), livability, economic development, and the environment. Many international and national organizations, such as the United Nations, the World Bank, the World Health Organization, the Transportation Research Board (TRB), and the U.K. Transport Research Laboratory, are actively working to convey advances in transportation to other nations, particularly in the areas of roadway safety and economy.

However, the benefits of these advancements are not understood or shared equally around the world. Reasons for this imbalance in the application of research findings and associated experience in planning and design have various origins. They range from a shortage of financial and human resources to a failure of policy makers to prioritize and take the necessary actions to strengthen the legal, economic, and technical decision-making framework of a country.

The concept of access management is one of these important developments in transportation planning and engineering. It is the careful consideration of the location, type, and design of access to a roadway and adjacent land development and involves a range of strategies to reduce conflicts among the various facility users. Drawing from experience in the United States, where access management policies and standards originated, the term "access management" is used to denote the systematic management of the location, spacing, design, and operation of driveways, median openings, interchanges, and street connections to highways and streets. It also involves medians, auxiliary turn lanes, and the appropriate spacing of traffic signals.

Access management improves the safety and operation of the transportation system at relatively low cost. Objectives are to limit access to development along major roadways, while promoting a supporting street system with unified access and circulation for corridor development. The result is a roadway system that functions safely and efficiently for all users and a more attractive corridor environment.

The benefits of implementing an access management process or program are well known and clearly documented. Nonetheless, a substantial disparity exists between the available technical documentation and guidance on the topic, and current long-range transportation planning, urban planning, and roadway design practices. Such practices range from a systematic application based on technical engineering and planning guidance to a complete absence or even adverse use of access control strategies in many parts of the world.

In recognition of this issue, the TRB Access Management Committee has initiated an action plan to promote and support the acceptance and integration of access management in the transportation planning and design decision processes of all nations. One component of the action plan was a survey of the international state-of-the-practice in access management. This e-circular includes findings and observation from that survey, as provided in country reports from various nations. The resulting findings form an initial platform for furthering the application of access management worldwide.

Background

To obtain information on the international status of access management, efforts were made to engage transportation researchers or professionals from each continent in the survey. Inquiries requesting volunteer participation were sent to transportation professionals and researchers from various nations that have participated in TRB Access Management Conferences, the TRB Access Management Committee, access management sessions at TRB Annual Meetings, as well as other selected international contacts of TRB Access Management Committee members.

Individuals from eight countries agreed to complete the survey and document their understanding of access management practices in their country. They include the following:

- North America: United States;
- Africa: South Africa;
- Asia: China and South Korea; and
- Europe: Germany, Greece, Poland, and the United Kingdom.

Authors of each country report were asked to focus on critical issues of the concept and provide specific information (if existing) with regard to the following:

• Historical background. Origins of and rationale for introducing access management or access control and the general evolution of the concept.

• Legal framework. The legal foundation, including laws, authority, and tools for controlling or managing access along the various roadway categories or functional classes (e.g., urban planning laws, building codes, national transportation and road operation laws, etc.).

• Roadway function. Roadway classes or functions where access management or control is addressed or dictates the level of access control associated with the road character.

• Access control schemes. Means by which a jurisdiction is engaging in the control of access on a public roadway and associated tools (e.g., agency policy, manual, regulations, or other guidance).

• Land use and development regulation. The jurisdiction over, and general means of, regulating land use and development along roadways, and the general nature of resulting mandates for managing or controlling access to a given roadway class.

• Enforcement schemes. Basic procedure and means of enforcing land use regulations and associated access controls or preventing and stopping illegal access points (e.g., development permit, access permit).

• Policies and standards. Technical information on permitting, regulating, and designing an access point and type of documentation (e.g., access permit, corridor management or master plan, road design manual, access management manual, land subdivision manual).

• Traffic modes. Access management policies that relate directly to the roadway access needs of pedestrians, bicyclists, transit and trucks, as well as automobiles.

• Perspectives. The future development of the means and tools for incorporating access management of the roadway system, based on the nation's experiences and problems with implementing access management to date.

• Other. Any other relevant information deemed critical or substantive for the development of an access management scheme in the country or region.

Also, to guide the TRB Access Management Committee on next steps for helping to advance access management in the various countries, additional specific information (if existing) was requested from each author on the following critical aspects of access management practice:

• Statutory or administrative rules and codes;

• Methods of documenting access management policies or criteria (e.g., access management manual, access issues in a road design manual);

- Access permit programs and procedures and their effectiveness;
- Location, spacing, and design standards for access connections;
- Roadway functional classification systems or typologies and their documentation;
- Access control methods for freeways (motorways);
- Land development regulations that relate to site access and circulation;
- Corridor access management plans, policies, and projects;
- Integration of access management in long-range transportation planning and associated time frames (e.g., 10, 20, or 30 years);
 - Education and training, formal or informal approaches; and
 - Special and country-specific access management issues.

The resulting information is divided into three parts. The first part includes country reports on access management practices from the participating authors. The second part includes a synthesis and comparative analysis of these national practices using the above general and specific issue areas. The third part presents observations and ideas for continued international advancement of access management.

This report is by no means a complete worldwide assessment of current access management practice. For example, at the time of this writing, the Emirate of Dubai in the United Arab Emirates had adopted an access management manual based on the 2003 edition of the TRB *Access Management Manual*. It is used for guidance and technical information. The Emirate of Abu Dhabi has recently prepared an *Access Management Policy and Procedures* manual. This is a regulatory policy and is current awaiting approval by the Executive Council.

The report does, however, provide many insights into the state of access management practice across the world. The report also reveals a clear need for greater international attention to access management and its application—particularly among agencies with an interest in international development and roadway safety.

COUNTRY REPORTS

United States

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BACKGROUND

Access management has grown as an important element of U.S. transportation and growth management policy.¹ Dramatic advances in access management have taken place along arterial roads since the 1980s, particularly in suburban settings. Colorado established the first statewide access management program in the United States (1981), followed by statewide codes in Florida (1988) and New Jersey (1989), and increased efforts in several other states. The American Association of State Highway Transportation Officials' *Policy on Geometric Design of Highways and Streets* (Green Book) (1) expanded its treatment of access management in 2000 and in 2003 the first national *Access Management Manual* (2) was published by the TRB. A second edition of the *Access Management Manual* was published in 2014 (3).

The origins of access management in the United States are in the boulevards of the late 19th century and the parkways and tollways of the early 20th century. These designs, based on the grand boulevards of Europe's major cities, provided a means of accommodating traffic growth in urban and urbanizing areas. The early boulevards had wide landscaped medians and direct property access was limited primarily to right turns.

In the decades between 1910 and 1940, the United States saw continued growth in population, urbanization, and motor vehicle travel. Parkways and tollways were developed in large metropolitan areas and progressively upgraded to accommodate commuter traffic. These precursors of modern freeways restricted highway access to interchanges or intersecting roads. Providing access only at long intervals was identified as a means of preserving highway operations and safety.

Following World War II, metropolitan areas expanded and motor vehicle travel increased. Development proliferated in suburban areas and with suburbanization came new building forms that relied on greater automobile access and abundant on-site parking. Various planning guidelines and articles during this period emphasized functional classification of roadway types based on their importance for mobility versus access. A 1962 *ITE Journal* article, Operational Measures–Future, was among the first publications to suggest controlled access arterials (4). Several states and counties were already building a type of controlled access arterial: the expressway.

Nonetheless, access control efforts remained weak or nonexistent in most states through decades of urban growth. Access spacing and auxiliary lanes as design elements were given little attention, and typical driveway permitting standards authorized driveways every 10 to 50 ft (5). Commercial strip development, historically along streetcar lines, continued in unrelenting fashion along arterial highways.² Local governments, cautious about exploring the full potential of their police powers over land development, did little to counter these trends (6).

The effect of unplanned access on highway safety, operations, and urban form was a growing concern in the United States. It led to the realization that a systematic approach to

managing access is a necessity. This approach emerged in the 1980s and has since evolved into the approach discussed in this primer.

Several basic principles underlie contemporary access management in the United States:

1. Provide a specialized road system in which different roads serve different purposes. A balanced roadway network serves a range of functions from higher speed, long-distance movement, where access must be controlled (e.g., freeways, expressways), to local access (e.g., local or minor collector streets), where speeds and traffic volumes are curtailed.

2. Limit direct access to major (arterial) roads. Direct property access should be limited along roads intended to serve higher volumes of traffic over longer distances at higher speeds; it should be denied whenever reasonable alternative access can be provided.

3. Long and uniform spacing of traffic signals on major roadways to favor through movement of traffic. Signalized access points should fit into an overall traffic signal coordination plan.

4. Remove turning vehicles from through-traffic lanes. Turn lanes allow drivers to decelerate gradually out of the through lane and wait in a protected area to complete a turn, thereby reducing the severity and duration of conflict between turning vehicles and through traffic.

5. Promote intersection hierarchy and provide appropriate transitions from one classification of roadway to another. A desirable practice is to allow direct connection to the next higher, or lower, functional classification. Avoid connecting a roadway of low classification (or driveway) directly to a roadway of a much higher classification.

6. Limit conflict points and separate conflict areas. Each conflict point is a potential collision. As a motorist percieves an increase in potential conflicts, the driving task becomes more complex and drivers are more likely to make mistakes. Conversely, a reduction in conflicts simplifies the driving task, contributing to improved traffic operations and fewer collisions. Driver safety improves when drivers are provided sufficient time to address one potential set of conflicts before facing another. This separation or spacing of conflict areas necessary to provide drivers with adequate perception and reaction time increases as travel speed increases. Separating conflict areas, through improved access spacing and use of nontraversable medians, helps to simplify the driving task and contributes to improved traffic operations and safety. It also reduces the exposure of pedestrians and bicyclists to automobile traffic (see Figure 1).

7. Locate access connections away from road intersections. Driveways and street connections should be located outside the functional area of road intersections or interchanges to preserve intersection safety and operations.

8. Provide a supporting street and circulation system. An interconnected network of collector and local streets improves local mobility, removes local trips from arterial roads, and reduces the need for direct property access to arterials. Unified access and circulation systems for development eliminate or reduce the need for vehicles to circulate on major roadways when moving a short distance from one establishment to the next.



FIGURE 1 Separating conflict areas reduces driver workload and the exposure of bicycles and pedestrians to potential crashes. (Source: Oregon Department of Transportation.)

LEGAL FRAMEWORK

In the United States, access management is achieved through two distinct authorities of state and local governments: police power and the power of eminent domain. Police power is the authority of government to further the public good in the advancement or the protection of public health, safety, morals, and general welfare. This authority is typically exercised in the form of regulations. The majority of access management strategies, including access regulations and permitting, represent application of the police power.

The acquisition of property access rights for access control, such as when establishing a freeway, represents the application of eminent domain. Eminent domain is the power of government to take private property for necessary public use with just compensation. Eminent domain is applied to achieve controlled-access roadways, and may include the control of several operational, design, and right-of-way elements of roadways. The governing agency may acquire all or partial access rights to properties that abut the roadway. An agency may also acquire the development rights to limit the traffic generation capability of a property abutting a roadway having partial control of access.

As noted previously, local governments in the United States have authority over land use and development. This authority is exercised in a number of ways, such as through adoption of comprehensive plans that include future land use and transportation plans and establish goals, objectives, and policies. Local governments also enact ordinances and adopt land development codes that guide urban development. State transportation agencies have full control over managing and improving state maintained highways and thereby administer access permits to state maintained highways.

In 1907, the U.S. Supreme Court recognized the sovereign power of the states to enact laws pertaining to property access rights. As a result, there is no single federal law that guides state access management practices. Access management laws and practices vary from state to state. In 1902, one of the first access management laws was enacted by the State of New Jersey, authorizing county boards to establish "speedways" for horses and light vehicles and to control the location of at-grade crossings and intersections (5).

In 1937, New York and Rhode Island enacted statutes authorizing state highway agencies to design and build "roadways that included the full or partial acquisition of abutting access rights" (5). In 1956, the Federal Interstate Highway Act authorized federal funds for the Interstate freeway system but required each state of provide full control of access as a condition for funding.

In the 1980s, Colorado enacted the first comprehensive, statewide access management program in the United States for all state routes. This is followed by statewide codes in Florida, New Jersey, and Oregon, and increased efforts in about a dozen states (generally falling short of comprehensive codes). These contemporary access management programs are characterized by the following key elements:

1. Classifying roadways into a logical hierarchy by function;

2. Defining allowable access for each class of roadway, (including standards for spacing of signalized and unsignalized access points);

3. Applying appropriate geometric design and traffic engineering criteria to each access point; and

4. Establishing policies, regulations, and permit procedures to carry out and enforce the program.

Authority for the state access management programs may be found generally in state legislation or expressly granted in access management statutes. Legislation establishes the criteria for access control and its regulation. Local government authority to engage in access management may be derived from planning and zoning enabling laws, state transportation laws, or comprehensive growth management laws. Codifying access policy in state and local standards, regulations, and procedures provides a necessary foundation for effective use of the police power based on legislative authority.

Sensible application of established regulatory and design standards can help ensure safe and orderly traffic flow and protect public agencies from regulatory "takings" or tort liability. Procedural consistency leads to a clear understanding of the application process and standards among the development community. Design consistency makes the system more predictable for drivers. Standards are more effective than guidelines in achieving consistent and desired outcomes.

Flexibility is also desirable to avoid precluding viable operational solutions and to address constraints posed by existing conditions, especially in retrofit situations. Clear procedures and criteria for review of deviations from standards provide flexibility without compromising the program through inappropriate variance decisions that become harmful legal precedents in the future.

ROADWAY FUNCTIONAL CLASSIFICATION AND ACCESS

The access classification or category system provides the foundation for contemporary U.S. access management programs. It defines when, where, and how access can be provided between

highways, cross streets, and driveways and relates the allowable access to each roadway's purpose, importance, and functional characteristics. The functional classification system is the starting point in assigning access categories to highways. Modifying factors include existing development, driveway density, and geometric design features such as the presence or absence of a physical median.

The types of allowable access between highways and surrounding developments cover a broad spectrum. Several basic access categories or levels can be applied to any state, county, or local road system. They range from full control of access, as along freeways, to access control only for safety reasons, as normally applied to local streets. Between these are other levels of controlled access that generally relate to the functional importance of an area's highways. The resulting access classification system identifies the allowable level of access for each roadway.

POLICIES AND STANDARDS

Policies and standards for access management vary considerably across the United States. Best practice is to key spacing standards for interchanges, signalized intersections, unsignalized intersections, and median openings to roadway functional classification and access categories.

Access management standards apply to new development and significant changes in the size and nature of existing developments. Existing substandard access design or spacing is upgraded to the extent feasible when the site redevelops or, in the case of medians, during the roadway improvement process. Communities with short blocks and frequent local street connections may be addressed through subcategories in the access classification system.

Access to parcels that do not conform to spacing criteria is provided when the parcel has no alternative reasonable access; however, the basis for such deviations must be clearly documented to avoid setting undesirable precedents. Conditions may be included in the access permit for removal of the access if alternative access becomes available.

Signalized intersection spacing criteria along roadways apply to both intersecting streets and driveways. The goal is to limit signals to locations where the progressive movement of traffic will not be significantly impeded and the "window" for progression at desired travel speeds is maintained. Excessively long cycle lengths (usually over 2 min) indicate a need for corrective actions such as interchanges, grade separations, rerouting left turns, adding lanes, or improving the secondary street system to reduce arterial left-turn volumes and provide alternative routes.

Unsignalized driveway spacing may be based on safe stopping sight distances, operating speeds, overlapping right-turn requirements, and more recently, decision sight distances. Spacing and design standards reflect roadway level of importance (access categories), roadway speeds, and the size of traffic generators. Left-turn storage requirements also influence spacing.

Medians reduce safety hazards posed by frequent access to major high-volume roads by organizing the left-turn movement. In some access categories, unsignalized directional openings may be allowed between signalized intersections to provide access to abutting properties and reduce U-turns and conflicting left-turns at signalized intersections. Replacing unsignalized full-median openings with directional openings is another technique to substantially reduce crash rates.

LAND USE REGULATION

Local governments in the United States have full authority over land use planning and regulation, but little or no authority over state highway access permitting. This separation of authority makes cooperation and coordination essential to access management. Where state and local agencies have acted independently, the typical result has been inconsistent decision making and enforcement problems.

Land use practices in the United States that have led to serious access problems along arterial roadways include division of land into individual lots with small frontages, commercial zoning and rezoning in strips along highway frontage, and approval of site plans with poorly designed site access and circulation. Figure 2 illustrates land division issues and preferred alternatives.

Key land planning actions currently being advocated for access management include (a) encouraging multiuse activity centers rather than single-use developments; (b) establishing minimum densities and infill incentives in designated activity centers and along express transit corridors; (c) orienting urban development along streets where appropriate for multimodal operations; and (d) promoting more effective local network planning to provide alternative access off of major arterials needed for through movement.

Mixed-use town centers or transit-oriented developments located on transit lines reinforce ridership and maximize internal circulation, thus posing fewer vehicular and pedestrian conflicts than strip development along major roadways. Zoning envelopes along new highways in rural and undeveloped areas are methods used to cluster commercial activity at key nodal points and minimize strip development. Development in some urban areas is being reoriented to the street line to create a better sense of place and improve pedestrian and transit access.

These concepts may be coordinated through a combination of regional plans, corridor plans, and specific-area (re)development plans. Other methods include form-based codes that key building form and street and block development to a regulating plan, which varies according to corridor characteristics (e.g., rural, suburban, urban, urban center) (7).



FIGURE 2 Control of lot splits (3).

Local government jurisdictions have applied land development regulations to manage access in a variety of ways. Subdivision regulations provide an opportunity to ensure proper access and street layout in relation to existing or planned roadways. Lots with frontage on two streets may be required to obtain access only on the street with the lower functional classification, unless this poses a safety hazard or would otherwise be impractical. Best practice is for subdivision regulations to cover all land division activity, including minor lot splits and commercial subdivisions. This offers an opportunity for reviewing agencies to ensure access to new lots created along major roadways is properly handled.

Another practice is the implementation of service roads—local or collector roads that generally provide alternative access to commercial tracts along a major roadway. Service roads are implemented in a variety of ways, but are most readily accomplished when land is being subdivided or consolidated for development. For example, developers may be required to set aside rights-of-way needed for the road as a condition of development approval, and the local government could construct and maintain the road. In some cases, developers may construct a portion of the road. In other cases, a local government may opt to complete undeveloped segments of the road where needed to maintain continuity or as an incentive for private participation.

Local governments may also enact policies and regulations for joint-use driveways and parking lot cross access to achieve unified access and circulation plans for adjacent commercial properties under separate ownership. Cross access allows traffic to circulate between commercial sites without reentering the abutting public roadway. Joint use driveways and cross-access easements must be included on the site plan. Affected property owners are encouraged to sign an agreement defining joint maintenance responsibilities. All agreements are recorded with the property records and constitute a covenant that runs with the land. Where provided, joint-use driveways are typically located at the property line of the initial site under development.

Integrated corridor management planning is promoting state and local government collaboration in some areas. States are beginning to provide technical assistance to local governments and some provide targeted grants for local network improvements that advance corridor management plans (e.g., Kansas) or other incentives for local participation.

ADMINISTRATION AND ENFORCEMENT

A state access code or administrative rule and a local land development code or access management ordinance provide the framework for administration and enforcement. Geometric design standards, traffic operations guidelines, and traffic impact study requirements will normally be updated for consistency with the program. State and local governments, sometimes in collaboration with regional agencies, may also jointly adopt a regulatory and improvement plan for specific corridors.

The separation of authority over land use and transportation in the United States creates a number of challenges related to access management. Local governments have authority over land use and development, whereas state transportation agencies have authority over maintenance and access to state highways. As a result, there is a need for extensive coordination to help ensure that involved agencies address both land use and transportation considerations.

The typical access permit application process includes consideration of the access classification of involved roadways and the ability of the proposed property access to meet

access requirements, such as location, spacing and design improvements. Access review may also involve traffic impact analysis, and circulation and safety assessments. Key issues in administering an access management program include setting fees for applications and permits, handling deviations from adopted standards, dealing with small lots, and upgrading access to land uses that redevelop.

MODES ADDRESSED

Historically, access management in the United States has been auto-centric. More recently, there has been a transition to a multimodal transportation system. As a result, the practice of access management has placed more emphasis on nonauto modes. Safety is being addressed not only in terms of reducing vehicular conflicts, but also conflicts at the interface between auto traffic, the pedestrian or bicyclist, and various forms of public transport. There has also been an increased impetus for local network development and network connectivity to support multimodal safety and operations.

One goal of access management is a more-coordinated approach to transportation and community design, one that discourages unplanned roadside development and reinforces desired urban form. Maximizing modal opportunities within a balanced "complete streets" framework has emerged as a consideration in the planning, design and maintenance of transportation corridors.³ The relationship of access management to nonauto modes, sustainability, and livability is a topic of growing importance that would benefit from additional research.

PERSPECTIVES

Access management has the potential to significantly improve the safety and operation of the transportation system at relatively low cost. It is the careful consideration of the location, type and design of access to a roadway and adjacent land development and involves a range of strategies to reduce conflicts among the various facility users. It grew from a recognition that vehicular maneuvers and volumes at each access point or intersection have measurable and cumulative impacts on the safety and operation of the transportation system.

The concept concentrates on restricting the number of direct accesses to major surface streets, providing reasonable indirect access, effectively designing driveways, enforcing safe and efficient spacing and location of access, providing medians on major roadways, and introducing auxiliary lanes for left and right turns. The practice is expanding to integrate access management principles into all modes of travel, including strategies for safe and efficient pedestrian, bicycle, and transit access.

Factors and influences that support access management include:

• Worsening congestion in urban areas and lack of funding for major capital improvements is leading to growing interest in strategies to maintain and manage the existing system;

• The push for improved safety and safety research funding;

• Budget deficits in all levels of government and the fact that access management is a lower-cost strategy than highway widening;

• Growing interest in strategies for integrating transportation and land use; and

• Growing interest and need to integrate access management principles and strategies

into nonauto modes of travel and other community interests, such as livability, economic development, and multimodal needs.

Table 1 presents success factors that have proven important in the administration and enhancement of state access management programs in the United States (8). The more of these factors that are present in an access management program, the more likely it is to succeed over time.

Factors and influences known to impede access management include:

• A general lack of familiarity with contemporary practice of access management and its benefits;

• Lack of nationally accepted guidelines coupled with significant variation of guidelines applied across the states and the many local government jurisdictions;

- Limited tools to predict the impacts of access management techniques;
- Inadequate number of case studies and examples of successful practices;
- Lack of federal government policy and programmatic support;

• Institutional challenges caused by the need for numerous agency functions, jurisdictions, and levels of government to coordinate in planning and implementation, an issue exacerbated by the separation of land use and transportation authority in the United States;

• Local stakeholder opposition, particularly by the business community due to perceptions that managing access may have negative consequences for their businesses; and

• Lack of resources, along with a continuing need, for outreach and education of agency management, staff, consultants, public officials, and the general public.

Performance measures and monitoring of access management, along with tools or methodologies for evaluating access management impacts, are sorely needed. The operational benefits of access management techniques, in particular, have not been sufficiently documented. Research and development of predictive tools and analysis methods is essential to improve our understanding of effective access management techniques and practices.

In sum, the practice of access management continues to evolve to meet contemporary needs. Access management in the United States is strategically positioned between the planning–policy and engineering–technical considerations of land use and transportation management. Roadway access management clearly improves arterial mobility and safety. As a central part of integrated land use and transportation corridor management, it also advances livability, energy, and sustainability objectives. The result of continued advancement of access management in the United States will be a more-sustainable energy-efficient transportation system, enhanced mobility, and improved community design and environmental quality.

Legislation	Strong access management authority provides the foundation for a
Legislation	successful access management program.
Access Classification	An ACS provides a framework for the comprehensive implementation of
System (ACS)	access management on a systemwide basis.
	Access management is most successful when the state transportation
Institutional commitment	agency has the institutional commitment to implement the program and
	integrate it into the daily business functions of an agency.
	Implementation efforts have the most effect when state transportation
Staffing	agencies and other transportation agencies can dedicate staff to access
	management.
A access champion	Often, a person (or persons) is needed to emphasize and support the access
Access champion	management agenda within an agency.
Legal case history	State transportation agencies with a strong case history of winning court
	cases are more empowered in making future access-related decisions.
	Real-world case studies that clearly illustrate the benefits of access
Case studies	management are instrumental in convincing elected officials, state and
Case studies	local government officials, the development community, and other
	decision makers of its merits.
Education and training	Access management training for agency staff is crucial.
Outreach activities	Elected officials, the development community, and the general public need
	to be educated about the rationale and benefits behind access management.
	Access management is best achieved when state, regional, county, and
Access committee	local units of government cooperate in land use and transportation
	management decisions.
	The defining characteristic of a successful access management plan is the
Stakeholder cooperation	level of cooperation achieved among affected property owners and
	agencies involved in developing and carrying out the plan.
Monitoring and evaluating	Any access management program will benefit greatly from continuous
and cvaluating	monitoring and self-evaluation to identify issues and resolve problems.

TABLE T Access Management Frogram Success Factors in the U	TABLE 1	Access Management	Program Success	Factors in the U.
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SOURCE: NCHRP Synthesis 404: State of the Practice in Highway Access Management (8).

NOTES

- 1. Access management practices vary significantly across state and local agencies in the United States from outdated and minimal standards to contemporary systemwide programs. This report conveys current best practices.
- 2. Local governments in the United States have authority over land development, whereas state transportation agencies have control over state-maintained highways.
- 3. The term "complete streets" refers to roadways designed and operated to enable safe, attractive, and comfortable access and travel by all users.

COUNTRY REPORTS

South Africa

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BACKGROUND

Road access management has been applied in South Africa (SA) for many years. During the 1980s guidelines were produced on national, provincial (state) and local level, and similar to geometric design standards, these guidelines were largely based on North American practice. Prominent researchers in the field, such as Vergil Stover, visited SA on several occasions to present courses on the subject. For the larger cities, the provision of access to filling stations off the major roads became a particular issue, and a number of them, including Pretoria and Port Elizabeth, developed guidelines focused on this matter.

On a national level, the Department of Transport had a research program during the latter half of the eighties and the early nineties, under which documents such as the following were produced:

• 1991: Access from and to Facilities Adjacent to National Freeways (title originally in Afrikaans);

• 1993: Spacing of Accesses on Major Arterials.

Since 2000 the subject developed substantially, with two major exercises playing dominant roles:

1. The Provincial Administration of the Western Cape (one of the nine provincial governments) produced a Draft Road Access Policy in 1996, which was superseded in 2001 with their Road Access Guidelines (9). This document introduced at least two new concepts, namely (a) the approach to subdivide the urban area into four development environments (based on land use), with different access standards for each environment, and (b) the application of different access spacing criteria for different conditions. The "policy" of 1996 and the later guidelines have been applied in practice in the Western Cape, including Cape Town, since being completed and good experience has been obtained. The document has recently been reviewed and an updated version is expected to be available in 2016.

2. The South African National Roads Agency Limited has developed national guidelines on access management and road classification. Their document, titled South African Road Classification and Access Management (RCAM) Manual (10), has been published as TRH 26 (*Technical Recommendations for Highways*), but it has not been formally approved by the Committee of Transport Officials (2016). It is the current national guideline document for South Africa; experience with the practical application thereof is limited. This work has introduced at least one new concept (now also included in the Second Edition of the Access Management Manual), namely the notion that there are only two functional classes of roads—mobility and access routes—with a distinct jump in function between them. This differs from the S-type functionality curve shown below. Much emphasis has been placed on first completing a detailed functional classification for the road network and then developing appropriate access management criteria based on the desired functions.

LEGAL FRAMEWORK

South Africa has a total road network of approximately 750,000 km in length, of which 140,000 km are unproclaimed roads in rural areas. The rest of the network is managed on three levels:

- South Africa National Roads Agency Limited: 22,000 km;
- Eleven provinces: 180,000 km; and
- Metropolitan areas and municipalities: 408,000 km.

The South African Constitution of 1996 established three levels of government—the national government, the nine provinces, and 262 municipalities. Each of the three levels is required to make their own laws on functions and responsibilities under their specific mandate.

These three levels of government manage, maintain, finance, enforce law, etc., on the roads under their jurisdiction according to the requirements of a number of acts of parliament, provincial ordinances and municipal by-laws. These requirements include access management.

National roads link major cities in all provinces (similar to Interstate system in the United States), and fall under a national roads act (the South African National Roads Agency Limited and National Roads Act of 1998), which among other provisions, gives the national roads agency the power to control all activities along these routes, including the building of accesses. The roads agency must further agree when land adjacent to a national road is subdivided, and will not allow developments to take place when these will negatively affect the operation of the road.

Each province uses its own provincial road management laws to administer its own network, and has similar provisions to the national act with respect to control of access and land development adjacent to the road. Provincial roads have a similar status to the state highways in the United States and consist of rural roads connecting towns, as well as important high-order roads in large urban areas.

Municipalities are meant to pass by-laws to manage their own roads, but most have not developed these as was meant to happen, since the 1996 Constitution provided for this. This leaves somewhat of a gap in legislation, with some municipalities lacking in the capacity and legal force to enforce proper road and access standards. Fortunately though, most of the Class 1, 2, and 3 municipal roads in the municipal areas are still administered under provincial legislation that gives them the required legal protection.

ROADWAY FUNCTIONAL CLASSIFICATION AND ACCESS

All road authorities have a road classification system. Figure 3 illustrates the road classification for the city of Cape Town metropolitan area. As indicated above, there is a difference between the proposed national approach to functional road classification and the traditional approach (S curve). For an illustration, see Figure 4. The national road classification is shown in Table 2, together with a comparison of a number of international classification systems.



FIGURE 3 Current city of Cape Town classification system.

		South Africa			USA			International		
, LO	Ŷ	RCAM 2010 (this	Highway functional	Policy on geometric	Transportation and	Access management	Access management	Great Britain	Australia	New Zealand
nct	BSS	manual) [COTO 2010]	classification	design of highways	land development	manual (State) [TRB	manual (Local) [TRB	ordnance survey		
5	ö		[AASHTO 1964, FHA	and streets [AASHTO	[ITE 1988, NCHRP	2003]	2003]	[DfT, HA]		
			1989]	1973, 2004]	1992]					
	1	Principal arterial	Principal arterial	Principal arterial	Freeway, expressway	1 Interstate highways	1 Freeway	Motorway, trunk	Freeway, M-route,	National road
			system, interstate	system, interstate		and other freeways		roads	state road, national	
÷									highway	
eris	2	Major arterial	Principal arterial	Principal arterial	Strategic arterial,	2 Roadway of	2 Major arterial	A-road, principal road	Major arterial, A-	Primary (regional)
(art			system, other	system, other	principal arterial,	statewide importance			route, regional road	arterial
£.					primary arterial	(strategic, principal				
lobi						arterials)				
≥	3	Minor arterial	Minor arterial road-	Minor arterial road-	Secondary arterial	3 Roadway of	3 Minor arterial	B-road	Minor arterial, B-	Secondary (district)
			street system	street system		regional importance			route, district road,	arterial
						(other arterials)			sub-arterial	
	4	Collector street (4a	Collector road-street	Collector road-street	Collector	4 District roadway	4 Major collector, 5	C-road, minor roads	Collector, C-route	Collector road
Set)		commercial, 4b	system, major and	system, major and		(collector)	Minor collector			
stru		residential)	minor collector roads	minor collector roads						
Â.	5	Local street	Local road-street	Local road-street	Local, cul-de-sac	5 Local	6 Local	Local street, alley,	Local, lane	Local road
cti		5a commercial, 5b	system	system				private road with or		
s/a		residential)						without public access		
Ses	6	Walkway (6a pedestrian	Terminal and transfer	Terminal and transfer				Pedestrianized street		
Acc		priority, 6b pedestrian	facilities	facilities				with restricted access		
		only)								

TABLE 2 Comparison of International Road Classification Systems

SOURCE: Committee of Transport Officials (COTO), South African Road Classification and Access Management Manual (TRH26), August 2012.



ACCESS CONTROL SCHEMES

The South African legal framework establishes three levels of road authorities that manage roads under their jurisdiction according to acts, provincial ordinances, and municipal by-laws. This framework provides the required legal backing to enforce decisions and rulings with respect to access. Guidelines are available to guide officials and land owners, and in special cases, traffic engineering professionals may be employed to influence road authorities and motivate special treatment. The final decision lies with the road authority and should any applicant consider his case to be handled unfairly, the courts are the last resort. The provision of access to land and the specific location thereof are considered so important that some cases do land in court.

LAND USE REGULATION

The use of land is controlled quite stringently through legislation. Every property has a right to access, but in the planning and design of roads, the way of providing access to adjacent land will always be carefully considered. Where poor decisions have been made in the past, or where the road function and abutting land use have changed over time, retrofitting will be attempted. Access management plans for the higher-order routes are being developed to address specific problematic situations.

All applications for a change in land use rights or a subdivision of any property for more intense use have to be accompanied by a traffic impact assessment (TIA), which specifically addresses the aspect of access. Site development plans have to be provided. The onus is on land owners-developers to have these TIAs prepared and submitted to the relevant authorities, and the approval process does take time (generally 6 months to 2 years).

POLICIES AND STANDARDS

The principal access management policy documents in South Africa, as noted above, are the RCAM and Western Cape *Road Access Guidelines* (RAG). These documents cover the field of access management quite well and in combination with the acts, ordinances and by-laws discussed under legal framework, they provide adequate legal backing to the road authorities to efficiently enforce land use schemes and access control.

Western Cape Road Access Guidelines

The RAG developed a unique approach to access management. It recognized that there are in effect four variables in the access management process, namely:

- 1. Different functional classes of roads;
- 2. Different types of driveways-intersections;
- 3. Different development environments (type and density of land use); and

4. Different technical criteria, which should be ideally complied with on the road network, and that have been used to calculate intersection–driveway spacing [e.g., egress conflict, left-turn conflict (driving on left side of road), stopping-sight distance, functional boundary distance, communication criteria (road signage) and weaving distances].

The RAG then developed a possible linkage between the four variables, which is illustrated in Table 3. Vehicle operating speeds applicable to the different conditions were selected to apply the technical criteria. The use of a specific criterion for every combination of development environment and road class was based on engineering judgement, but it is considered that this approach constitutes a novel approach to the issue of determining ideal driveway spacing under different road and land use conditions.

Through application of the criteria, a master table with minimum access spacing has eventually been developed as a guideline (Table 4). Note that a left-only access refers to left in–left out driveways (driving on the left-hand side). For countries driving on the right-hand side, this equates to right in–right out.

Development Environment	Hi	igh Order A	rterials	Distr	100000	
	Freeway	Express- way Primary		District	Local	Road
Urban	WD	SIG	SSD	FBD	SSD	EC
Intermediate	WD	SIG	SSD	FBD	SSD	EC
Suburban	WD	SIG	FBD	FBD	SSD	LTC
Semi-Rural	WD	SIG	FBD	FBD	SSD	SSD
Rural	WD	CC	CC	CC	CC	SSD

TABLE 3 Application of Access Spacing Criteria: Western Cape RAG

			Road Classification							
Development Environment		Access Type		Class 1 Expressway	Class 2 Primary Arterial/ Primary Distributor		Class 3 Secondary Arterial/ District Distributor		Class 4 Minor Road/ Local Distributor	
		Operating Speed		60km/h	50	m/h	40-50km/b		35-40km/h	
	Unsignalised	Low Vol Driveway	<50veh/h		60	60	45	45	25	25
Urban	onoignaileee	High Vol Driveway	<250veh/h		120	75	60	60	45	45
>10.000m ² GEA/ha		Equivalent Side Road	<450\/eh/h	540	120	90	90	75	60	60
P to ovoill Gr Avia	Signalised	Equivalent olde Hodd		540	375		275		225	aqui e
	Median Open	ing		540	120	日常原始的	90	1255533	60	98927C
		Operating Speed		70km/n	60)	km/h	50	.m/h	50	m/h
	Unsignalised	Low Vol Driveway	國防爆制法	90	90	45	45	25	25	
Intermediate		High Vol Driveway	<125veh/h	Stretchicky	180	100	75	75	60	60
3 000-10 000m ² GEA/ha		Fourivalent Side Road	<375\/eh/h	800	180	120	120	90	90	75
5 000-10 000m Of Pena	Signalised	Equivalent olde rioud	800	540	SELECTION .	375	Market St.	275	02072	
	Median Open	ing		800	180	PANA STATE	120		90	362
		Operating Speed		90km/h	70km/h		60km/h		50km/h	
	Unsignalised	Low Vol Driveway	<50veh/h		CO STORE		all shares and	0432323	45	45
Suburban	1	High Vol Driveway	<250veh/h		COLLARS &		SELECT		60	60
1.000-3000m ² GEA/ha		Equivalent Side Road	<450Veh/h	1200	270	160	180	120	120	90
1000 000011 0170110	Signalised	Equitation close ricede	1200	800		540	10000000	375	Pality and	
	Median Open	ling	1200	270	AND A STREET	180		120		
		Operating Speed		100km/h	80km/h		70km/h		60km/h	
	Unsignalised	Low Vol Driveway	<50veh/h		CREATER D	1201223	1883-1893 1993			
Semi Rural		High Vol Driveway	<150veh/h	Selection of the select				Ser a	建建料	1220723
<1 000m ² GFA/ha		Equivalent Side Road	<150Veh/h	1600	400	200	270	155	180	120
	Signalised	1-3		1600	1200	的影响感到	800		540	资源和303
	Median Open	ing		1600	400	3.22.52.2	270		180	28475
		Operating Speed		120km/h	120	km/h	110	km/h	80	km/h
Rural	Unsignalised	Driveway	<50veh/day	600	500	500	450	450	300	300
Natural/Agricultural		Equivalent Side Road	<500Veh/day	1600	600	600	450	450	450	450
-	Signalised			这些网络政治的		2596557		AND IN	an the state of the	696 M M
	Median Oper	ing		1600	600		450		300	9452 million

 TABLE 4 Western Cape Minimum Access Spacing Criteria

South African Road Classification and Access Management Manual

Table 5 details the key access management requirements and features (proposed for national application) as provided in the RCAM.

MODES ADDRESSED

Pedestrians, cyclists and transit are not treated explicitly in the access management guidelines, although they are certainly considered. Separate national guidelines for the treatment of these modes exist.

Basic	Des	cription	REQUIREMENTS					TYPICAL FEATURES (use appropriate context sensitive standards for design)								
Function	Class	Class name	Design	Route no.	Intersection	Access to	Parking	Speed	Inter-section	Typical cross	Roadway /	Road	Public	Pedestrian	Cycle	Traffic
	No (U_)		typology		spacing	property		km/h	control	section	lane width	reserve	transport	footways	lanes	Calming
												width	stops and	(constructe		
													ped. xing.	d)		
	1	Principal	Freeway	Yes	2,4 km (1.6	not allowed	No	100-	Interchange	4 / 6 / 8 lane	3.3 - 3.7 m	60 - 120	No	No	No	No
		arterial		(M/R/N)	km - 3.6 km)			120		freeway	lanes	m (60 m)				
	2	Major	Highway	Yes (M/R)	800 m (±	Not	No	80	Co-ordinated	4 / 6 lane	3.3 - 3.6 m	38 - 62 m	Yes at inter-	Off road	Yes –	No
Mobility		arterial			15%)	allowed*'**			traffic signal,	divided,	lanes	(40 m)	sections		widen	
									Interchange	kerbed					roadway	
	3	Minor	Main road	Yes (M)	600 m (±	Not	No	70	Co-ordinated	4 lane divided	3.3 - 3.5 m	25 - 40 m	Yes at inter-	Yes	Yes –	No
		arterial			20%)	allowed*'**			traffic signal,	or undivided,	lanes	(30 m)	sections		widen	
									roundabout	kerbed					roadway	
	4a	Collector	Commercial	No (A for	> 150 m	Yes (larger	Yes if	60	Traffic signal,	4 lane, median		20 - 40 m	Yes at inter-	Yes	Yes, widen	Median for
		street,	major	temp.		properties)	conditions		roundabout or	at ped. xing.,		(25 m)	sections or		road or on	peds,
		commercial	collector	routing)			allow		priority	boulevard,			mid block		verge	curved
										CBD one-way						roadway
	4b	Collector	Residential	No	> 150 m	Yes	Yes if	50	Roundabout,	2/3lane	6 - 9m	16 - 30 m	Yes	Yes	Yes, on	Raised
		street,	minor				appropriate		mini-circle or	undivided	roadway,	(20 m)	anywhere		road or	ped,
		residential	collector						priority		< 3.3 m				verge	median,
											lanes					narrow
																lanes
	5a	Local street,	Commercial	No		Yes	Yes if	40	Priority	2 lane plus		15 – 25 m	If applicable,	Normally	Use	Raised
		commercial	access				conditions			parking		(22 m)	anywhere	yes	roadway	ped.
Access /			street				allow									crossing
Activity	5b	Local street,	Local	No		Yes	Yes on	40	Mini-circle,	1 / 2 lane	3.0 - 5.5 m	10 - 16 m	If applicable,	Not	Use	Yes, but
		residential	residential				verge		priority or	mountable	roadway	(14 m)	anywhere	normally,	roadway	should not
			street						none	kerbs	(two way)			pedestrians		be
														can use		necessary
														roadway		
	6a	Walkway,	Pedestrian	No	500 m	Yes	Yes if	15	None,	Surfaced			If applicable,	Yes or use	Rare	Yes
		non-	priority		maximum		parking lot		pedestrians				anywhere	roadway		
		motorized					or woonerf		have right of							
		priority							way							
	6b	Walkway,	Pedestrian	No	500 m	Yes	No	peds.	None,	Block paving		6 m		Yes	Yes	
		non-	only		maximum		vehicles	80 m /	pedestrian							
		motorized						minute	signal							
		only														

TABLE 5 South African Urban Access Management Requirements and Features

* Access to properties sufficiently large to warrant a private intersection / interchange can be considered if access spacing requirement met and there is no future need for a public road.

** Partial and marginal access at reduced spacing allowed to relieve congestion, reduce excessive travel distances or remove the need for a full intersection

SOURCE: COTO, TRH26, August 2012.

PERSPECTIVES

Recent work on access management in South Africa brought the following perspectives to the fore:

1. The matter of a quantum jump in road function between mobility and access routes versus the traditional S-curve (Figure 4).

2. The concept of using development environments in urban areas to allow for different access standards (e.g., central business district and suburban).

3. How, where, and when the available spacing criteria should be applied.

4. Road classification does have an important implication for the provision of access to land owners. Currently the classification process is done by officials with no input from the public. This is not considered adequately transparent by some.

5. Although the access guidelines and standards are being applied rigorously by most authorities, certain situations, such as the servicing of regional shopping centers, do not comply fully with the current standards. This leads to a question regarding the approach to access management standards, i.e., are they real or is it a matter of only striving to achieve them without ever really succeeding?

6. The same question as in 5 arises with respect to road classification. Standards for the spacing of different classes of roads have been developed, but in practice (for many reasons) it is virtually impossible to provide higher order routes everywhere at these typical spacings. Statements on the inability to provide higher order routes according to ideal standards, appear to be required.

COUNTRY REPORTS

China

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BACKGROUND

China implements a strict access regulation scheme based on a socialist land ownership tradition. This regulatory scheme offers little comparison to that of the United States and other nations reviewed given the different societal context and institutional structures. The ability of China to centralize decision making on a national level provides an exceptionally strong legal framework for the integration of a nationally defined concept of access management throughout transportation and land use planning, engineering, and regulatory activities.

LEGAL FRAMEWORK

The Chinese legal framework adopted for controlling or managing access along the various road categories or functional classes includes the following.

Land Administration Law of the People's Republic of China (1998)

The law addresses land proprietary rights, land use rights, land use regulations, overall plans for land utilization, land expropriation compensation, land use changes and approval, and so on. Some important regulations include:

1. The nation maintains socialist public ownership of land, meaning land is owned by the whole population or collective. Usually urban district land belongs to the state, and rural land belongs to a collective, unless specified otherwise by law.

2. The nation has the right to expropriate land from a collective for public benefits.

3. The nation maintains a system of compensated use of state-owned land, except for land where the right to use is allocated by law.

4. The nation strictly implements land protection policy.

Urban and Rural Planning Law (2007)

This law relates to urban system planning, urban planning, town planning, rural planning, and village planning. Each urban or town plan includes an overall plan and a detailed plan. A detailed plan is divided into a regulatory plan and site plan. This law specifies the organizer, compiler, and examination and approval authority of a plan. Details such as plan formulation, enforcement,

revision, supervision, inspection, and legal liability are also specified in this law. Some important regulations are listed below:

1. The local people's government has legal responsibility for local urban and rural plans. It could delegate a local department with the necessary planning qualifications to develop the plan.

2. The law emphasizes that the planned right-of-way associated with airports, highways, railways, harbors, transmission line corridors, and pipelines should be strictly protected.

3. Right to use of state-owned land can be extended through transfer, but conditions such as the nature of use and intensity of development must be stipulated in the land contract.

4. Compensation should be paid to licensees suffered losses due to the revision of urban and rural plans after they received license.

Highway Law of the People's Republic of China (2004)

This law applies to the planning, construction, maintenance, operation, use, and administration of highways within the territory of the People's Republic of China. Some key regulations include:

1. Plans for land to be used for highway construction shall coordinate with the overall plan for land use. Plans for lower-class highways should be consistent with plans for upper-class highways.

2. Where approved highway plans need to be revised, proposals shall be submitted by the original entities that developed the plans to the original authorities that approved them.

3. To add an at-grade intersection, approval must be obtained in accordance with relevant state regulations and technical standards.

4. No buildings or surface structures may be built within building-control zones on both sides of a highway, except for the buildings that are needed for protection and maintenance of the highway.

Road Traffic Safety Law of the People's Republic of China (2004)

The purpose of this law is to maintain road traffic order, prevent or decrease traffic accidents, and promote transportation efficiency. The law addresses drivers and vehicles, road traffic regulations, managing roadway accidents, administration, and legal liabilities. Some key regulations include the following:

1. The nation applies a compulsory third-party liability insurance system to motor vehicles.

2. The local people's government is responsible for administrative planning of road traffic safety, and the public security department shall be responsible for the administration of road traffic safety.

3. Uniform road traffic signals shall be applied throughout the country.

4. Whoever digs a road, occupies a road to carry out construction, or engages in other activities affecting road traffic safety shall first obtain approval from the public security department.

5. A newly constructed or reconstructed road should pass inspection by the highway administration and public security department before opening to traffic.

ROADWAY FUNCTIONAL CLASSIFICATION AND ACCESS

The Ministry of Transportation and Ministry of Housing and Urban–Rural Development administer highways and urban roads, respectively. There are five classes of highways and four classes of urban roads.

Highway System

There are five classifications of highways: Expressways, Class I Highways, Class II Highways, Class III Highways, and Class IV Highways.

Expressways

Expressways are the highest class in the highway system and support high-speed and highvolume traffic [more than 25000 passenger car unit (pcu)–equivalent annual average daily traffic (AADT)]. In order to guarantee expressways achieving the posted speed limit of 80 to 120 km/h safely and efficiently, access is strictly controlled. The main access standards for expressways are summarized below:

1. A restrictive median with limited median openings must be provided on multilane expressways to separate opposing traffic movements and to prevent unauthorized turning movements.

2. It is recommended that interchanges be spaced more than 4-km apart. Shorter spacing may be permitted when special conditions are met, but the minimum distance (measured between the endpoint of the acceleration lane of one interchange and the start point of the deceleration lane of the next interchange) should not be less than 1,000 m.

3. Direct access shall be for right turns only on expressways unless special conditions are met and approved by the appropriate authority.

4. The minimum length of acceleration and deceleration lanes are strictly controlled according to the design speed of expressways.

5. Emergency access is recommended to allow entry for first responders.

Class I Highways

Class I highways connect important political centers, economical centers, key industrial and mining areas, airports, or harbors. AADT ranges between 15,000 to 55,000 pcu. Access is partially controlled to support the design speed. These highways can be classified as either arterial highways or collector–distributor highways.

The main access standards for Class I Highways with arterial functions are summarized below:

1. Class I Highways as arterials should be generally capable of achieving a posted speed limit of 80 to 100 km/h safely and efficiently.

2. A restrictive median with limited median openings should be provided on multilane facilities to separate opposing traffic movements and to prevent unauthorized turning movements.

3. Class I Highways enjoy controlled access. The design standard of controlled access is similar to that for expressways. Facilities separating mainline motorized traffic from roadside mixed traffic should be implemented to minimize side disturbance.

4. Direct access for other local or rural highways should be strictly controlled to decrease the number of at-grade crossings.

5. At-grade crossing is permitted only if the design hourly volume of the crossed road is less than 80. Distance between at-grade crossings should be no less than 2,000 m.

The main access standards for Class I Highways with collector-distributor functions are:

1. Class I Highways with collector–distributor functions should be generally capable of achieving a posted speed limit of 60 to 80 km/h safely and efficiently.

2. A restrictive median with limited median openings should be provided on multilane Class I highways to separate opposing traffic movements and to prevent unauthorized turning movements. When nonmotorized traffic volume is high, slow traffic lanes and separation facilities should be provided to minimize side disturbance for motorized travel.

3. Distance between at-grade crossings should be no less than 500 m. Mainline priority control or traffic signals should be used to reduce longitudinal and transverse disturbances.

Class II Highways

These highways have the capacity for medium to high travel speeds and moderate traffic volumes (5,000 to 15,000 pcu-equivalent AADT). These highways can be categorized as either arterial highways or collector–distributor highways. The main access standards of Class II Highways are summarized below:

1. Class II Highways with arterial functions should be generally capable of achieving a posted speed limit of 80 km/h. Class II Highways with collector–distributor functions should be capable of achieving 60 km/h speed safely and efficiently, although a 40 km/h speed is acceptable when topographical challenges are present.

2. A slow traffic lane should be provided when the volume of mixed traffic is high, and pavement markings should be implemented to better channelize traffic and reduce side disturbance.

3. Direct accesses connecting other local or rural highways should be controlled to decrease the number of at-grade crossings.

4. Spacing between at-grade crossings should be no less than 500 m for arterial function highways and 300 m for collector-distributor function highways.

5. Intersection channelization, main traffic priority controls, or traffic signals should be used to reduce longitudinal and transverse disturbances.

Class III Highways

These highways have the capacity for moderate travel speeds and moderate traffic volumes (2,000 to 6,000 pcu-equivalent AADT). The main access standards for Class III Highways are summarized below:

1. Class III Highways with arterial function should be generally capable of achieving a posted speed limit of 40 km/h, although a 30 km/h speed is acceptable when topographical restrictions are present.

2. Intersection channelization should be implemented to support turning traffic.

Class IV Highways

These highways have the capacity for lower travel speeds and lower traffic volumes (less than 2,000 pcu-equivalent AADT). Class IV Highways with arterial function support speeds up to 20 km/h due to topographical restrictions.

Urban Roads

Urban roads are classified into four types: freeways, principal arterials, minor arterials, and collectors. They are explained briefly below.

Freeways

Freeway is the highest class road in the urban road system and supports high-speed and large-volume traffic (more than 40,000 pcu-equivalent AADT). In order for a freeway to achieve the posted speed limit of 60 to 100 km/h safely and efficiently, its access is strictly controlled. The main access standards for freeways are summarized as follows:

1. Public buildings housing major traffic generators should not be located on either side of freeway.

2. A restrictive median with limited median openings must be provided on multilane freeways to separate opposing traffic movements and to prevent unauthorized turning movements. Along a freeway with collector–distributor functions, a lateral separation zone must be provided between the main road and side road to minimize side disturbance.

3. Interchanges, which include complete interchanges, partial interchanges, and separated interchanges, should be applied when a freeway crosses another road. Spacing between exit and entrance should be no less than a certain distance to make sure that main road traffic is not affected by distributary or integration traffic. A collector–distributor lane is recommended when the spacing is insufficient.

4. Interchange categories and form should be chosen properly to operate the freeway safely and efficiently. The three types of interchanges are described in Table 6, and the recommended categories for specific contexts are listed in Table 7.

5. The minimum length of acceleration and deceleration lanes is strictly controlled according to the freeway design speed.

Interchange Type		Description
A1		Directional, trumpet, combined full interchange
A: System interchange	A2	Trumpet, cloverleaf, semidirectional, combined full interchange
		with directional or semidirectional ramps
B: Local interchange		Trumpet, cloverleaf, diamond, circuit, combined full or partial
		interchange
C: Separated interchange		—

TABLE 6 Interchange Type and Description

TABLE 7 Recommended Interchange Type Based on Intersecting Facility Type

Intersecting Facility	Recommended Interchange	Optional Interchange
Туре	Туре	Туре
Freeway vs. freeway	A1	—
Freeway vs. principal arterial	В	A2, C
Freeway vs. minor arterial	С	В
Freeway vs. collector		C
Principal arterial vs. principal arterial		В

Principal Arterials

Principal arterials connect major traffic generators, and serve high traffic volumes and highspeed travel. The main access standards for principal arterial roadways are summarized below:

1. Principal arterial roadways are generally capable of achieving a posted speed limit of 40 to 60 km/h.

2. Principal arterials serve primarily a mobility function. Public buildings that house major traffic generators are not suitable to be located on either side of a principal arterial.

3. At-grade intersections are created when a principal arterial crosses another principal arterial, minor arterial, or collector roadway. The three at-grade intersection categories are briefly described in Table 8, and the recommended intersections for various contexts are listed in Table 9.

Intersection Type		Description
A · Signalized intersection	A1	Signalized control, widened approaching intersection
A. Signalized Intersection	A2	Signalized control, nonwidened approaching intersection
	B1	Turning right only for collector traffic
B: Unsignalized intersection	B2	Stop sign or yield sign
	B3	Uncontrolled intersection
C: Roundabout		—

TABLE 8 Types of At-Grade Intersections
Intersecting Facility	Recommended Intersection Type	Optional Intersection Type
Principal arterial vs. principal arterial	A1	_
Principal arterial vs. minor arterial	A1	_
Principal arterial vs. collector	B1	A1
Minor arterial vs. minor arterial	A1	
Minor arterial vs. collector	B2	A1 or B1
Collector vs. collector	B2 or B3	C or A2

TABLE 9 Recommended Intersection Types based on Intersecting Facility Types

Minor Arterials

As an important part of the arterial network, minor arterials have the capacity for medium travel speeds and traffic volumes. The main access standards for minor arterials are summarized below.

1. Minor arterials should be generally capable of achieving a posted speed limit of 30 to 50 km/h.

2. The major function of minor arterials is to collect and distribute traffic. Minor arterials may also have a service function.

3. Appropriate intersection types for at-grade crossings are listed in Table 9.

Collectors

Collectors connect minor arterial roadways with local streets. They support moderate travel speeds and traffic volumes. The main access standards for collectors are summarized below.

1. Collectors should be generally capable of achieving a posted speed limit of 20 to 40 km/h.

- 2. The major function of collectors is to distribute local traffic.
- 3. Appropriate intersection types for at-grade crossings are listed in Table 9.

ACCESS CONTROL SCHEMES

In China, road access control is implemented in a series of procedures from general land use planning to routine access management.

Method of Inspection in Formulation of General Land Use Planning (2009)

This regulation was issued by the Ministry of Land and Natural Resources to standardize the formulation, inspection, and approval of general land use planning. It addresses the organizer, qualification of compiler, inspection, and approval department. This regulation also specifies the elements of urban plans and the level of detail required.

Methods of Urban Plan Formulation (2005)

This code was issued by the Ministry of Housing and Urban–Rural Development to normalize urban planning nationwide. It contains requirements as to the initiation, development, and contents of urban plans in China. The urban arterial road network and traffic hub layout are two important required elements of urban plans. This code also specifies required contents of regulatory plans and site plans. It requires developing a traffic circulation and design scheme according to the traffic impact analysis in the site planning phase.

Implementing Regulations of Urban Plan Formulation (1995)

This code was issued by the Ministry of Housing and Urban–Rural Development to specify requirements for implementation of urban planning regulations. It specifies required documents that need to be collected, plan contents, scale of technical drawings, and so on. Parcel boundaries, locations of public facilities, roadway classifications, roadway alignments, cross-section designs, coordinates, and elevation of controlled access points should be specified in regulatory plans. Technical aspects such as land area, construction area, plot ratio, and greenspace ratio should be specified in site plans.

Code for Design of Urban Road Engineering (2012)

This code was issued by the Ministry of Housing and Urban–Rural Development to guide urban roadway design. It includes basic requirements for roadway capacity, level of service, cross-section design, horizontal and vertical alignment, at-grade intersections, pedestrian and bicycle facilities, public parking, city squares, roadway safety, and traffic control devices, etc. Detailed design requirements are provided to guide and control urban roadway design, especially for intersections.

Planning and Design Specifications for Intersections on Urban Streets (2011)

The Ministry of Housing and Urban–Rural Development issued these specifications to guide planning and design of urban at-grade intersections and interchanges. Key contents that relate to access are summarized as follows:

1. Intersection design processes and products at different planning or design phases such as urban master planning, urban short-term site planning, urban district planning, regulatory detailed planning, traffic engineering planning and design, and intersection reconstruction.

2. Intersection planning and design specifications such as right-of-way red lines, building restriction lines, vehicle types, clearance, design speeds, and design traffic volumes and capacity.

3. At-grade intersection spacing, types, and sight triangle calculations.

4. Traffic organization, design contents, and approaching lane design for unsignalized intersections.

5. Approaching lane design, departing lane design, and signal control schemes for signalized intersections.

6. Roundabout planning and design, including signal control schemes.

- 7. Intersection planning and design.
- 8. Interchange system planning and interchange design.

Design Specifications for Highway Alignment (2006)

These specifications were issued by the Ministry of Transportation to guide highway engineering and design. They address highway classification, highway traffic capacity, route selection, highway cross-section design, highway horizontal and vertical alignment, at-grade intersections, interchanges, highway–railway intersections, and so on. They also specify access standards, such as:

1. Spacing of intersections and interchanges.

2. Sight triangle calculation, turning lane length, and at-grade intersection channelization.

- 3. Length of interchange acceleration, deceleration, and auxiliary lanes.
- 4. Interchange diffluence and interfluence location.

5. Channelization design for intersections with connecting lines or ramps and crossroads.

National Standard of the People's Republic of China—Road Traffic Signs and Markings (2009)

This standard was issued by the China Standardization Technical Committee to guide highway design, urban road design, road safety administration, and traffic law enforcement. It regulates the classification, color, text, size, graphics, and location for roadway signs and markings to promote consistency and order. It also guides the coordination of roadway signs and roadway markings.

Technical Standards of Traffic Impact Analysis of Construction Projects (2010)

These standards were issued by the Ministry of Housing and Urban–Rural Development to coordinate land use and transportation and standardize traffic impact analyses. The standards address classification of construction projects, traffic impact analysis, impact thresholds, travel demand analysis, and impact mitigation. The thresholds of traffic impact analysis are shown in Table 10.

LAND USE REGULATION

The local people's government is responsible for developing the General Land Use Plan. The plan is usually prepared by local administrative entities. The General Land Use Plan has the full force of the law and specifies land use regulations and restrictions.

The Ministry of Housing and Urban–Rural Development guides the planning and construction of urban and rural areas in China. The overall plan is strategic and macroscopic and includes urban system planning and urban center planning. Urban system planning determines land use scale and usable land range. Urban center planning determines spatial distribution of

Population of City or		Construction Area of Project (in thousand square meters)		
Town (in millions)	Project Location	Residential	Commercial/Other	
	Urban center	30-80	10-30	
≥ 2	Urban area (except urban center)	50-100	20-50	
	Other area	100-200	40-100	
1.2	Urban center	20-50	10-20	
1-2	Other area	30-80	20-50	
<1	Any	20-80	10-50	

TABLE 10 Traffic Impact Analysis Thresholds

usable land, together with land use intensity, building density, building height, plot ratio, population capacity, and so on. Overall urban planning provides the guiding framework for urban district area planning.

Urban district area planning addresses issues such as spatial distribution, functional zoning, land use regulations, and population distribution. It also addresses issues such as urban arterial roads' right-of-way (red line) location, cross-section design, and elevation of control points. Finally, it specifies the location and scale of intersections, squares, bus terminals, and transportation hubs.

Regulatory planning outlines land use and zoning designations and specifies building density, building height, plot ratio, greenspace ratio, entrance–exit locations, parking spaces, and building setbacks.

Site planning is the most detailed planning. It illustrates the spatial layout of buildings, roads, and greenspace. Traffic management schemes are developed according to traffic impact analyses for important parcels.

ENFORCEMENT SCHEMES

Land use regulations are enforced by a serial procedure from general land use planning to site planning, where strict rules for plan formulation and revision are applied. The planning process and products are shown in Figure 5.

The approved regulatory plan has legal force, and arbitrary revisions are forbidden. Revisions should follow the procedure outlined below:

- The necessity of revisions should be discussed among experts. This discussion is organized by the administrative entity responsible for developing the plan.
- The planning authority should invite stakeholder comments in the form of a hearing or other setting.

• The planning authority should submit the proposed revisions to the original approving authority. Stakeholder feedback should be submitted as well.

• The plan revisions should be reviewed and approved according to the legal process.

• When required contents of the urban master plan are undergoing revision, the urban master plan mustbe revised according to legal procedures.



FIGURE 5 Planning process and products in China.

Highways and urban roadways are designed by qualified design institutes according to the approved highway network plan or urban traffic plan. Access design follows the standards and specifications noted in the previous section. Road projects are monitored and inspected for consistency with established standards to ensure project quality. Highways and urban streets should be reviewed and approved by the police, highway, or urban–rural development administrative department before opening to traffic.

The police administer road traffic safety. Traffic management and access control may be adjusted according to changes in travel patterns. Safety assessments are performed periodically to identify candidates for safety improvement projects. Improvement projects are proposed through joint consultation. Median dividers, yield signs, stop signs, traffic signals, widening of approaching lanes, and traffic channelization are typical tools in the access control toolbox. Police may require the highway department or urban development department to modify accesses where needed.

A traffic impact analysis is required for all new development that exceeds specific traffic impact thresholds. The site entrance–exit, parking lot layout, and roadway impacts should be demonstrated. Should new development cause significant traffic delay, construction plan revisions or mitigation measures are required to mitigate such impacts.

POLICIES AND STANDARDS

Spacing of Intersection

1. Spacing of at-grade intersections. At-grade intersection spacing depends on roadway function, class, and impact on roadway safety, capacity, and delay. The minimum required spacing is shown in Table 11.

2. Planning of at-grade intersection spacing. At-grade intersection spacing is based on the size of the city, intersection location, and functionality of the roadway. The spacing requirements for these contexts are shown in Table 12.

Design Standards of Interchange Entrance and Exit

1. Ensure necessary recognition sight distance before entrance–exit gore point.

2. Table 13 shows the minimum recognition sight distance according to design speed. The minimum recognition sight distance should be more than 1.25 times of stopping sight distance.

3. There should be a visibility triangle between the ramp and main line before confluence end. Within the shaded area shown in Figure 6, sight line should not be blocked.

Design of Entrance and Exit Ramps

Interchange ramp entrances should be placed in the right lane except for high-speed ramps. Both sides of the diffluence end offset outwards to widen the gore area, as shown in Figure 7, Figure 8, and Figure 9. The offset value and the radius of gore nose are tabulated in Table 14. The transition ratios according to design speed are shown in Table 15.

Highway Class	Function of Highway	Spacing (m)
	Artorial	2,000 (general value)
First class	Alterial	1,000 (minimum value)
	Collector-distributor	500
Second close	Arterial	500
Second class	Collector-distributor	300

 TABLE 11 Minimum At-Grade Intersection Spacing

City Scale	Location	Roadway Type	Spacing (m)
	Downtown oros	Primary road	400-600
Larga aity	Downtown area	Branch road	150-300
Large city	Derinhard or residential area	Primary road	500-700
	Peripheral of residential area	Branch road	250-350
	Downtown oros	Primary road	500-700
Small madium aity	Downtown area	Branch road	250-350
Small-medium city	Derinhard or residential area	Primary road	600-800
	Peripheral of residential area	Branch road	300-400

 TABLE 12 At-Grade Intersection Spacing

Design Speed (km/h)	Recognition Sight Distance (m)
120	350-460
100	290–380
80	230–300
60	170–240

 TABLE 13 Minimum Recognition Sight Distances According to Design Speed



FIGURE 6 Visibility triangle.



FIGURE 7 Narrow hard shoulder.



FIGURE 8 Wide hard shoulder.



FIGURE 9 Bifurcation in main line.

Diffluent Mode Offset Value on Main Line Side, C ₁ (m)		Offset Value on Ramp Side, C ₂ (m)	Gore Nose Radius, <i>r</i> (m)	
Exit ramp	2.5-3.5	0.6-1.0	0.6-1.0	
Main line bifurcation	≥1.8	≥1.8	0.6-1.0	

TABLE 14 Offset Values and Radius in End

FABLE 15	Transition R	atios Accordin	ig to D	esign Sj	peed
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Design speed (km/h)	120	100	80	60	≤40
Transition ratio (l/m)	1/12	1/11	1/10	1/8	1/7

Design of Speed Change Lane

The speed change lane consists of direct and parallel forms. The deceleration lane should be direct and the acceleration lane should be parallel if there is only one speed change lane. Both the deceleration and acceleration lane should be direct if there are two speed change lanes. See Figure 10, Figure 11, Figure 12, and Figure 13 for graphical representations of the various speed change lanes.

Table 16 shows the required length of speed change lanes given various scenarios.



FIGURE 10 Single exit ramp lane in direct form.



FIGURE 11 Single lane in parallel form.



FIGURE 12 Double lane in direct form.



FIGURE 13 Double lane in direct form with auxiliary lane.

Balance of Lane

The expressway should remain a fixed number of lanes entirely or between the important junctions. Between two adjacent sections, the variation of the number of lanes in one direction shall be no more than one. In expressways, the number of lanes on the confluence and diffluence between the main line and the ramp should be balanced following the formula below:

 $N_C \ge N_F + N_E - 1$

As illustrated in Figure 14, N_C is the number of lanes before the diffluence or after the confluence; N_F is the number of lanes after the diffluence or before the confluence; and N_E is the number of lanes in the ramp.

T S C	ype of Speed hange Lane	Mainline Design Speed (km/h)	Length of Speed Change Lane (m)	Transition Ratio (l/m)	Length of Transition Section (m)	Mainline Hard Shoulder Width (C ₁)	Radius of Diffluence– Confluence End <i>r</i> (m)	Hard Shoulder Widening in Diffluence End C ₂ (m)
		120	145	1/25	100	3.5	0.60	0.60
	Single	100	125	1/22.5	90	3.0	0.60	0.80
la	lane	80	110	1/20	80	3.0	0.60	0.80
cit		60	95	1/17.5	70	3.0	0.60	0.70
Ey		120	225	1/22.5	90	3.0	0.70	0.70
	Double	100	190	1/20	80	3.0	0.70	0.70
	lane	80	170	1/17.5	70	3.0	0.70	0.90
		60	140	1/15	60	3.0	0.60	0.60
		120	230	-(1/45)	90 (180)	3.5	0.6 (0.55)	
	Single	100	200	-(1/40)	80 (160)	3.0	0.6 (0.75)	
	lane	80	180	-(1/40)	70 (160)	2.5	0.6 (0.75)	
ance		60	155	-(1/35)	60 (140)	2.5	0.6 (0.70)	
Entra		120	400	-(1/45)	180	3.5	0.63	
	Double	100	350	-(1/40)	160	3.0	0.63	
	lane	80	310	-(1/37.5)	150	2.5	0.67	
		60	270	-(1/35)	140	2.5	0.50	

 TABLE 16 Required Length of Speed Change Lanes



FIGURE 14 Expressway lane balance.

China

For multilane ramps (i.e., $N_E > 1$), auxiliary lanes should be installed at both entrance and exit ramps as shown in Figure 15.

Spacing of Adjacent Entrances and Exits

The general positioning design of adjacent entrances and exits is shown in Figure 16. The minimum spacing of adjacent entrances and exits is shown in Table 17.

Design Index of At-Grade Highway Intersections

1. Traffic management of intersections. The traffic management of intersections can be divided into three kinds: main road priority, no priority, and signal control. If there are significant differences in the two intersected roads, or if there is a high volume of traffic at a three-way intersection, then main road priority should be adopted. If the class and traffic are low in the two intersecting roads, then no priority should be adopted. If traffic volume is high on both roads, there are significant class differences between the two roads, or traffic delays and accidents occur, then signal control should be adopted.

2. Design speed of intersection. The design speed on major roads within the intersection range should be the same as it is in the section. If the two intersected roads are similar, the design speed of the straight lane within the intersection range can be reduced appropriately, but it should not be lower than 70% of the section design speed.



FIGURE 15 Auxiliary lane installation at entrance and exit ramps.



FIGURE 16 Adjacent entrance and exit spacing.

Mainline	Mainline design speed (km/h)			120	100	80
		General value		350	300	250
L_1 Spacing L_2 L_3	Minorvoluo	Primary road	300	250	200	
	winor value	Branch road	240	220	200	
	General value	300	250	200		
	Minor value	System interchange	240	200	200	
		Service interchange	180	160	160	
	General value		200	150	150	
	L_3	L_3	Primary road	150	150	120
		winor value	Branch road	120	120	100

TABLE 17 Minimum Spacing of Adjacent Entrances and Exits

3. Angle. A right intersecting angle is desirable for an at-grade intersection. If the angle is oblique, it should be not less than 70° , and it should be not less than 60° if limited.

4. Sight distance. At an uncontrolled intersection, the visibility triangle formed by the stopping sight distances of both roads must be clear of any sightline obstruction. The visibility triangle formed by the sight distances of two intersecting roads with similar design speeds is illustrated as the shaded triangular area in Figure 17.

The visibility triangle at priority intersections consists of safe stopping sight distance in the major road and the stop line 5 to 7 m away from the major road's center line in the minor road if limited, as is shown in Figure 18. The safe stopping sight distance in intersections is as shown in Table 18.



FIGURE 17 Intersection visibility triangle.



FIGURE 18 Safe stopping sight distance in intersection.

Design Speed (km/h)	Stopping Sight Distance (m)	Safe Stopping Sight Distance in Intersection (m)
100	160	250
80	110	175
60	75	115
40	40	70
30	30	55
20	20	35

TABLE 18 Safe Stopping Sight Distance in Intersections

Turning Lane Installation

If the design speed of the major road is greater than 60 km/h, additional acceleration and deceleration lanes are required. If two Class I highways or a Class I and a Class II highway intersect, an additional right-turn lane is required.

All four-lane highways should install left-turn lanes at intersections except those with low traffic volumes. If a Class II highway intersects with an expressway, or high nonmotorized traffic exists with no slow travel lane provided, or if traffic delays and accidents may occur due to lack of left-turn lanes, left-turn lanes are required on the Class II road.

Length of Speed Change Lane

The length of speed change lanes should follow that tabulated in Table 19. The length of the transition section for a speed change lane should follow that shown in Table 20.

Design of Intersections on Urban Roads

Unsignalized Intersections

Unsignalized intersections can be of no control, yield controlled, or stop controlled.

		Length of Deceleration Lane (m)			Lengt	h of Accele Lane (m)	ration
Type of	Design Sneed	$\frac{a = -2.5 \text{m/s}^2}{\text{Terminal Speed (km/h)}}$			Initi	<u>a = 1.0 m/s</u> al Speed (k	² m/h)
Highway	(km/h)	0	20	40	0	20	40
	100	100	95	70	250	230	190
Major highway	80	60	50	32	140	120	80
Major inghway	60	40	30	20	100	80	40
	40	20	10		40	20	
	80	45	40	25	90	80	50
Minor highway	60	30	20	10	65	55	25
	40	15	10		25	15	
	30	10			10		

TABLE 19 Required Length of Speed Change Lanes

 TABLE 20 Required Length of Transition Section for Speed Change Lanes

Design (km/h)	Length of Transition Section (m)
100	60
80	50
60	40
40	30

In residential or industrial zones, if the intersecting roads are similar, or the intersecting roads have less than 800 entry vehicles per hour in peak travel periods, then no control is necessary at the intersection. If the intersecting roads have between 800 and 1,500 entry vehicles per hour during peak travel periods, then yield control is necessary. If sight distance is limited, or if the intersecting roads have between 800 and 1,500 entry vehicles per hour during peak travel periods, and a yield control may not be sufficiently safe, or the intersection is located among signal-controlled intersections, then the intersection shall be stop controlled.

At uncontrolled intersections, pedestrian crossings and yield signs are required. At stopcontrolled intersections, pedestrian crossings, stop signs, and pedestrian push buttons are required.

Signalized Intersections

1. Planning and design of approach-entry lanes:

– Number should be twice the number of the planning lanes in the upstream typical cross section.

- Width in new or reconstruction, the minimum width should be 3.0 m; and the minimum width should be 2.7 m if limited.

- The total length L_a consists of the transition section L_d and the widened section L_s (Figure 19). $L_d = 10\Delta w$. Δw is the horizontal offset (m), $L_d \ge 20$ m. $L_s = 9N$. N is the average number of queued turning vehicles in each signal cycle of a 15-min period, $L_s \ge 30$ m.



FIGURE 19 Approach lane length.

2. Planning and design of the exit lanes:

- Number should match the maximum number of upstream entry lanes of the same intersection.

- Width should be no less than the width of the typical cross section; the minimum width should be 3.25 m.

- Length: $L_s = 50 \sim 80$ m. $L_d = 20 \Delta w$, Δw is the horizontal offset (m), $L_d \ge 30$ m.
- 3. Vehicle entrances and exits for land and buildings.

4. New intersection planning. For new intersection planning, vehicle entrances and exits should be placed abutting the branch or internal roads of the land and buildings. Traffic generated by land and buildings reaches upper class roads, such as minor arterial roads through these branch feeder and internal circulation roads.

5. Reconstruction and governance intersection planning. In reconstruction and governance intersection planning, the vehicle entrances and exits for land and buildings should be placed according to guidance tabulated in Table 21.

PEDESTRIAN AND BICYCLE CONSIDERATIONS

1. Pedestrian crossings. Pedestrian crossings can be planned and designated either as atgrade crossings or interchange crossings. The at-grade or interchange selection should consider roadway functional classification, types of road intersections, traffic control method, and topography. The location of pedestrian crossings should be coordinated with locations of bus stops, rail transit stations, and major pedestrian traffic generators, such as shopping malls. Some design and control regulations are summarized below:

- Sight obstruction by bridge piers should be avoided when setting up pedestrian crossing under elevated roads; twice crossing safety islands and traffic signals should be provided to facilitate pedestrian crossing operations (see Figure 20).

- Pedestrian crossing locations should be coordinated with the existing corner traffic islands (Figure 21).

	Distance to Stop Line of the Closest Upstream or		
	Downstream Intersections (m)		
Major arterial road	>100		
Minor arterial road	>80		
Branch road	>50		

 TABLE 21 Separation from the Closest Upstream or Downstream Intersections



FIGURE 20 Pedestrian crossings under an elevated road.



FIGURE 21 Pedestrian crossings at an intersection with corner traffic islands.

- The maximum length of a pedestrian crossing should be no longer than 15 m. If the crossing is longer than 15 m, a pedestrian refuge island should be provided in the middle of the pedestrian crossing. The minimum width of the island should be 2 m; the minimum length is 1.5 m. Three types of pedestrian refuge islands are shown in Figure 22, Figure 23, and Figure 24.



FIGURE 22 Pedestrian crossing distance reduction using refuge islands.



FIGURE 23 Reduction of spacing corner curve area.



FIGURE 24 Reduction of approaching and departing lane width.

- Pedestrian crossings should be placed at unsignalized intersections or yield control intersections, and warning signs indicating pedestrian priority should be installed.

- Pedestrian signals include regular signals and push-button-activated signals. The allotted time should be long enough for pedestrians to cross safely, and the waiting time should be minimized.

2. Bicycle crossings. There are three traffic designs for bicycle crossing in intersections:

- Exclusive lane for approaching and departing. When bicycle traffic volume is high, exclusive lanes for approaching and departing should be provided, and guardrails or separation bars should be installed between motor vehicles and bicycles. In this case, the organization of bicycles crossings at an intersection is the same as that for motorized vehicles (Figure 25).

Vehicle–bicycle shared lanes. If bicycle volume is moderate and it is difficult to establish an exclusive bicycle lane, a vehicle–bicycle shared lane may be acceptable. Roadway markings should be installed to distinguish shared lanes from vehicle-only lanes. Motor vehicles may occupy the shared lane and make a right turn. Bicycle traffic organization can be either the same as that of vehicles or pedestrians (Figure 26).

- Bicycle-pedestrian shared lanes. If bicycle volume is low, a bicycle-pedestrian shared lane for intersection crossing is acceptable. In this case, traffic organization for bicycles is usually the same as that for pedestrians (Figure 27).



FIGURE 25 Exclusive bicycle lanes at an intersection.



FIGURE 26 Vehicle-bicycle shared lanes at an intersection.



FIGURE 27 Bicycle-pedestrian shared lanes.

PERSPECTIVES

Access management techniques are able to help mitigate traffic congestion and accidents on highways and urban streets. In China, access management has recently received much attention and will continue to develop due to the rapid increase in urbanization and motor vehicle travel. The following are some expected goals and outcomes related to access management in the future:

1. Systemic research projects on access management will be implemented, and more and more access management research groups will emerge.

2. Many engineering projects related to regional congestion, traffic safety at intersections, and traffic impacts analyses will create opportunities to finance and implement access management techniques. Access management tools will be proposed, experimented, revised, and implemented.

3. Access management techniques will focus on addressing some of China's unique challenges, such as high bicycle-content mixed-traffic volumes, low consciousness of traffic safety, shortages of land suitable for roadway construction, and so on.

4. The China Access Management Manual will be developed to help improve traffic problems nationwide.

COUNTRY REPORTS

South Korea

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BACKGROUND

South Korea has a relatively short history of highway construction. A total highway length of 34,476 km was recorded in 1960 and a 29.5-km long first modern freeway was opened to the public in the year 1972 to connect Seoul and Incheon, which was followed by Seoul–Busan freeway in 1970 with a total length of 428.0 km. In preparation for the 1988 Seoul Summer Olympics, the South Korean government made a great effort of highway construction, resulting in a total highway length of 56,715 km (freeways 1,551 km) in the year 1990.

Highway construction is important for a strong economy, and constructed highways should remain efficient and safe even after major land developments occur during their life span. In this regard, it is strongly recommended by many highway design policies and guidelines that highway access management practice be applied. However, in the 1990s period of rapid highway construction, the South Korean government was not aware of its importance. For example, in Highway Geometric Design Standards and Regulations (1975), which described national design standards for highway geometric features, only one sentence addressed highway access management, stating that vehicles entering or exiting freeways shall do so through freeway interchanges. As a result, many access problems have occurred along nonfreeway arterial highways in South Korea.

In the late 1990s, South Korean highway engineers recognized the importance of highway access management. The main reason for this recognition was an explosive demand for highway construction. The central government established the freeway network with a 7×9 grid pattern and newly constructed freeways and arterial roads became available to South Korean motorists only after the mid-1990s. Motorists started to enjoy driving on freeways and this experience made them want to enter the freeways as quickly as possible.

Responding to this demand, the government made an ambitious highway investment. In 1996, the arterial road network was 29,611 km, compared to 22,832 km in 1988. Obviously, the new highways promoted land development along their routes and this resulted in requests for more access to the newly constructed highways. The government belatedly started to discuss highway access management. NCHRP 348 (*11*) published by TRB was one of the main references in this discussion. However, the discussion failed to create any legislative actions, such as laws or regulations, due to strong opposition by landlords and restaurant owners who already possessed access to major highways.

Apart from freeways and arterial roads, the remaining highways (including minor arterials, collector–distributors, and local roads) were totally excluded from the discussion of highway access management. Fifteen years after the initial discussion, incessant requests from academia for proactive highway access management measures led government officials to again discuss access management for Korea's highways. The result was a separate chapter on highway access management by Korean highway engineers in the 1999 update to the *Highway Geometric*

Design Standards and Regulations (1975). Despite this change, some officials were still reluctant to support the general application of highway access management. Presently, however, most South Korean officials now support the application of highway access management.

LEGAL FRAMEWORK

The legal framework for highway access management in South Korea includes urban planning laws and their enforcing regulations, as established by the central government. In addition, Korea Land and Housing Corporation, which is a government-affiliated private company responsible for land development in South Korea, also published a land development manual to facilitate a timely fulfillment of their tasks. However, this manual lacks a detailed procedure for enforcing highway access management. Municipal governments, including Seoul Metropolitan Government, also published urban planning manuals but none of them considered or addressed highway access management issues.

ROADWAY FUNCTIONAL CLASSIFICATION AND ACCESS

South Korea adopted American highway design theory described in *A Policy on Geometric Design of Highways and Streets* published by AASHTO (1). This American publication classifies highways according to their functions as arterial, collector–distributor and local roads. The same classification is applied in access management classification in South Korea.

ACCESS CONTROL SCHEMES

In South Korea, access control schemes are generally established by urban planners. This is because, although highways are the main subject to be controlled, access permits and locations are determined by urban planners. Therefore, to apply highway access management successfully in South Korea, urban planning professionals must be consulted with closely. The following demonstrates various urban planning laws, regulations and policies where access management is or could be addressed.

• *Highway Geometric Design Standards and Regulation*, Ministry of Land Transport and Maritime Affairs, 2009;

- Urban Planning Law, Ministry of Construction, 2000;
- Regulation for the Plan and Use of Home Land, Ministry of Land, Transport and Maritime Affairs, 2010;
- Planning Guidelines and Regulations for Public Facilities within Urban Areas, Ministry of Land, Transport and Maritime Affairs, 2011;
 - Manual for Urban Planning, Seoul City Government, 2007;

• Manual for New City Development, Ministry of Land, Transport and Maritime Affairs, 2010; and

• Guidelines for Residential Area Development Plan, Korea Land Development Corporation, 1995.

In addition, many international manuals and guidelines have been obtained by South Korea to better coordinate transportation and land development. These international publications are used only for reference, but committee members participating in various governmental committees often apply these publications while making technical decisions. They include the following:

- Access Management Manual, TRB, 2003;
- NCHRP Report 348: Access Management Guidelines for Activity Centers, TRB, 1992;

• *A Policy on Geometric Design of Highways and Streets*, American Association of State Highway and Transportation Officials, 2004; and

• Transportation and Land Development, Institute of Transportation Engineers, 2001.

LAND USE REGULATION

When land developers are entering contracts for buildings or subdivisions along existing highways or streets, they need to provide the locations, forms and geometric details of the access road to cities. A follow-up approval committee will be established and committee members determine the appropriateness of these proposals. This committee is usually operated in the Department of Urban Planning, and the committee members also perform duties related to zoning regulations.

ENFORCEMENT SCHEMES

When a proposed development plan fails to satisfy requirements addressed by highway access management principles, the urban planning committee must decline the proposal.

POLICIES AND STANDARDS

As stated previously, South Korea has a limited experience in applying highway access management. Detailed studies on highway access management are required in the future.

MODES ADDRESSED

Transportation modes covered in the highway access management publications in South Korea are only motor vehicles. Access management for nonmotorized modes is generally ignored.

PERSPECTIVES

It is unclear whether South Korea can apply highway access management more actively than it does today. This is because there is a strong tendency in the central government favoring deregulation for every aspect of government administration. Therefore, today's highway engineers generally wonder whether applications of highway access management in South Korea are promising.

COUNTRY REPORTS

Germany

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BACKGROUND

The highly efficient German rural road network currently comprises around 12,900 km of federal freeways and 40,000 km of federal highways, making it one of the densest rural road networks in Europe. Since the reunification of Germany in 1990, over 2,100 km have been added to the freeway network. Around 1,800 km have been widened to six or more lanes. In addition, around 3,300 km of federal highways have been upgraded or constructed. This figure includes around 590 bypasses.

Germany has recently accomplished a long process that has led to a new design approach for highways and streets. This approach aims at establishing standardized roadway design classes in order for them to become self-explaining such that the road users behavior coincides as much as possible with that anticipated by the road designer. This new design approach is applied for urban streets, rural highways, and both rural and urban freeways.

One of the fundamental principles for realizing the above mentioned concept is to categorize all roads in the network according to their primary function in the road network with

a. The link category meaning the link environment and type between locations, cities, or regions (e.g., for freeways, rural highway, but also urban roads) and

b. The link function level representing the traffic or mobility importance or intensity of the connection (e.g., continental traffic, national, regional, local).

This principle is illustrated in Table 22. This categorization, as it is defined by the corresponding guide RIN [Richtlinien für integrierte Netzgestaltung (Guidelines for Integrated Network Planning)], has proved to be a rather valuable tool for the determination of adequate design elements. In addition, it provides a useful tool for communication among planners and design engineers. Its application achieves the development of a hierarchical road network, which is the basis of all well-functioning operation of roads according to its predominant function. Moreover, it contributes to adequate traffic safety. All the design guidelines determine their design elements along these categories

LEGAL FRAMEWORK

In the Federal Republic of Germany, a highway law is applicable for each federal state. In this highway law, access conditions and driveway design details to public roads are usually and to some extent explicitly regulated. In addition, when an urban plan exists, the design of the driveway is directly referred to in the building rules incorporated in the plan. All highway laws

Category Group Link Function Level	Freeways: AS	Rural Roads: LS	Rural Roads in Non-Built-Up Areas (Suburban Roads): VS	Roads in Built-Up Areas: HS	Local Roads: ES
Continental: 0	AS 0				
Subcontinental: I	AS I	LS I			
Interregional: II	AS II	LS II	VS II		
Regional: III		LS III	VS III	HS III	
Subregional: IV		LS IV	_	HS IV	ES IV
Local: V		LS V	_		ES V
Scope of application	RAA	RAL	RASt		

TABLE 22	German	Road	Categories	and	Scope

NOTE: AS I = designation of the category as it occurs; gray shaded cells = problematic; — = does not exist or is not justifiable; RAA, RAC, RAS = German technical design regulations.

SOURCE: Road and Transportation Research Association (FGSV) (ed.). RIN, Guidelines for Integrated Network Planning, Cologne, 2008.

of the states provide the right of one access point for every roadway abutting property. Additional access points generally necessitate a special access permit.

ACCESS PERMITS

All property accesses to public roads require a permit from the controlling authority for the roadway. For example the Northern–Rhein–Westphalia State Highway Law of 1995 states in §20 (12):

• Driveways are the specific connection between a property and the abutting public roadway. Installation of a new driveway, amendment of an existing driveway, or change in the type of traffic or significant increase of the volume using the driveway, imposes a special roadway use and therefore a special permit is required.

• The controlling authority may impose restrictions on the position, type, form and design of the driveway to accommodate special requirements related to road safety and ease of traffic flow.

An example of a local government driveway permit application is shown in Figure 28.

ROADWAY FUNCTIONAL CLASSIFICATION AND ACCESS

Germany has extensive documented guidance relating to roadway design. As indicated above, according to German roadway design guides, roadways are characterized by their functional aim. The typical functional categorization of the roadway network in Germany is shown in Figure 29.



Stadt Gotha Abt. Straßenverwaltung als Straßenbaulastträger Ekhofplatz 24

Auskunft erteilt:

Zimmer Nr. Tel. (03621) 222-Fax.(03621) 222-

<u>Antragsteller</u>

(
Name	:			
Straße	Applicant data			
Wohnort	Applicalit data			
Den de N				
Bauantrag Nummer	:			
Antrag auf Herste	ellung einer Zufahrt im Bereich der	r öffentlichen Verkehrsfläc	he oder auf	
bauliche Änderun	ig einer vorhandenen Zufahrt	Application for		
Ich beantrage hiermit		1) New driveway	7, or	
die Anlegung einer Zu	fahrt	2) Existing drive	way	
die Änderung einer vo	rhandenen Zufahrt	Vehicle type use (na	ssenger	
zu meinem) Grundsti	ick in Gotha	car, heavy vehicle, a	gricultural	
		vehicle).		
(Straße)		(Hsnr.) (Gemarkung	g, Flur, Flurstck.)	
an der im Lageplan un	d umseitiger Skizze angegebenen Stelle.			
Die Zufahrt wird benö	tigt/ genutzt als			
Garagenzuf	ahrt für	Personenkraftwagen		
Stellplatzzu	fahrt	Lastkraftwagen	t	
Hof- bzw. F	irmenzufahrt	landw. Fahrzeuge		
Für den Fall der Anlegung oder Änderung einer Zufahrt wird ein einmaliges Entgelt in Höhe von 61, Declaration that any bin gleichzeitig bereit die entstehenden Mehrkosten gegenüber den normalen Erschließungs- bzw. St Declaration that any change to plans or Change to plans or				
1) Ist der Antragsteller nicht der Grundstückseigentümer ist die schriftliche Zustimmung des Grundstückseigentümers beizufi				
Mit meiner Unterschrift erkläre ich darüber belehrt worden zu sein, dass jede bauliche veranderung an der Zufahrt (z.B. Breite, Länge der Bordabsenkung, Art der Zufahrtsbefestigung usw.) einer erneuten				
Gestattung bedarf	und deshalb vorher bei der Abteilung	Tiefbau der Stadt Gotha bear	tragt werden	
muss.				
Gotha,				
		(Unterschrift)		

Lageplan der Zufahrt (maßstäblich) ist dem Antrag beizufügen.

FIGURE 28 Access permit application for the city of Gotha at a cost of 61.40 €.



FIGURE 29 Typical functional classification of roads and road network in Germany. (Source: T. Raeder-Grossmann, Colloquium for Rural Road Design, Cologne, June 18, 2013.)

This categorization has been set according to the concept of self-explaining roads (SER). The SER concept aims to ensure that each class of roadway has consistent design features (i.e., cartway, markings, lighting, signing) so that drivers intuitively understand how to behave on that given class of roadway.

Level of Mobility Function 0 designates roadways with the highest traffic importance and therefore is associated with roadways having full access control. For Level of Mobility Function I to V, access management gains gradually in importance. The concept of access management becomes especially critical for roadways in built-up areas for Level of Mobility Function primarily between Levels II to IV.

Design controls for all roadway categories in Germany are provided in three documents:

- Guide for the Geometric Design of Freeways (Motorways), RAA, 2008;
- Guide for the Geometric Design of Rural Highways, RAL, 2012; and
- Guide for the Geometric Design of Urban Streets, RASt, 2006.

From Table 22 and Figure 29 it becomes evident that freeways, both rural and urban, are fully access-controlled roadways per design and enforced by legislation (Level of Mobility Function O-II). All other road categories may have direct or indirect access from road abutting properties and land uses. A separate access management manual does not exist in Germany. Urban and suburban roadways present the most-critical cases for access control, especially those with Level of Mobility function II-IV. These types of roads are designed in Germany based on two primary criteria:

1. Traffic control:

- Connecting function of road (mobility level),
- Access function (type and intensity use of all traffic modes, freight requests), and
- Traffic volumes.
- 2. Urban planning control:
 - Area character (village, center, residence, historical middle-age area, etc.),
 - Land use and pedestrian road use pattern, and
 - Road space settings.

These design controls play a central role in all urban streets (Figure 30 through Figure 32).



VILLAGE MAIN STREET

FIGURE 30 Examples of typical German street types and designs.



FIGURE 31 Examples of a typical design of an entrance street (13).



FIGURE 32 Examples of a typical design of a commercial street (13).

PROPERTY INGRESS AND EGRESS DESIGN

Examples of typical ingress and egress designs to roads abutting residences are shown in Figures 33 and 34 (13). Other examples of typical ingress and egress designs to road abutting properties are illustrated in Figure 35.



FIGURE 33 Example of ingress and egress design with raised paving with ramp slopes 1H:7V–1H:10V and with a minimum width of 3.00 m (13).



FIGURE 34 Example of ingress and egress design with sidewalk and bicycle lane crossing with a minimum width of 3.00 m (13).



FIGURE 35 Examples of typical ingress and egress designs of road abutting properties (13). (Legend: maximum combined slope p = 6%; minimum $l_3 = 3.00$ m; $l_2 = 1.00$ and 2.00 m for cases b and c or d, respectively.)

PERSPECTIVES

In Germany due to the country's federal system and its strong regulation framework that has evolved for many centuries and related to land policy in conjunction with regional and urban planning law in addition to the public road laws an application of access management as conceived in the United States is in the short-term difficult. Technically the principles of driveway design and installation can be implemented through traffic and road engineering design studies like the one shown in Figure 36 on the distance between driveways adjacent to railway tracks (14).



FIGURE 36 Distance between driveways adjacent to railway tracks (14). [Note: l_r = distance between driveways (m); l_a = stopping sight distance (m); d = railway clearance distance (m); and l_{st} = 20 m for vehicles, 18 m for tractors.]

COUNTRY REPORTS

Greece

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BACKGROUND

The Greek road network currently comprises 5,028 km of Trans European roads (part of the European road network), 12,000 km of national roads, 40,000 km prefectural roads, and about 200,000 km of county roads. Depending on this jurisdictional distribution of the country's road network, every road is operated and maintained by various stakeholders and agencies. The trans-European roads are operated and maintained mostly by concessionaires (toll roads) or a small portion of them directly by the Ministry of Infrastructure, Transport, and Networks; the primary national roads by the ministry, while the secondary and tertiary national roads as well as all prefectural roads by the Prefectures. All county roads are operated and maintained by the counties. Conflicting jurisdictional authority is observed in some parts of the road network, especially on the frontage roads of freeways.

A special characteristic of the development of the Greek road network—particularly the county roads within built-up areas—is that this network was developed on an ad hoc basis based on private land subdivision action during the 1950s and 1960s, when the country's private income development rate could not keep pace with the country's authorities' capacity to develop the necessary urban plans. This situation is today resulting in major difficulties with implementing a successful access management scheme in Greece.

STATUTORY OR ADMINISTRATIVE RULES AND CODES

Urban planning law and related requirements for spatial development in Greece differ greatly from those associated with traffic studies and roadway design. According to existing urban planning legislation, areas within and outside of those areas covered by an urban plan have different building rules as well as different restrictions relating to access conditions, such as the location of access. Outside the urban plan, access control is required for most all uses, other than single family residential. For areas within the city or urban plan, access control is required only for uses with 30 or more parking spaces (*15*, *16*).

Alternatively, Greek transportation legislation [Greek policy for Road Design (ISR– FRC)] (17), requires that roadways be functionally classified based upon their importance to through traffic movement and the regions they connect, as illustrated in Table 23. These classifications apply regardless of whether the roadway passes through areas within or outside the city plan. Mobility vs access demand or priority and road adjacent land use planning is associated directly with the designated level of traffic importance of every road. The higher the level of traffic importance (Levels I—fully access controlled roads—and II, according to Table 22) the greater weight is placed on the mobility function of the road. Access management gains in importance gradually from level of traffic importance II to V.

In addition to the level of traffic importance, roadways are also organized according to the character of the surrounding land and built environment, as shown in Table 24. Together, these criteria establish the desired correlations between density and functional street levels. Moreover, it is indicated that primarily collector and local roadways should provide for access to abutting properties (*17*, Ch. 2). The functional road category should actually provide the framework for successful urban planning and incorporation of access management criteria. However beyond the typical challenges with implementing access management experienced worldwide, the fact that many urban settings in the country were developed in a nontechnical and arbitrary manner imposes an additional impediment of incorporating access management measures.

ROADWAY FUNCTIONAL CLASSIFICATION AND ACCESS

The process for functional classification of roadways in Greece is set forth in OMOE LKOD (Instructions for Studies of Road Works: Functional Road Category, *15*).

The combination of road connection type (numbers I through V) and roadside context type (letters A through E) defines the individual road category for administrative purposes. For example, Class AI roads are designated as rural freeways, while Class BI roads are designated as urban freeways. Freeways are fully access controlled. On expressways (Class AII and BII), ingress into the roadway is allowed only as a right turn maneuver. Class I and II roadways require grade-separated intersections due to their high mobility functions.

The problem with the functional classes and roadside categories in Greece is that there is no correlation whatsoever with the administrative requirements in legislation. Greek law defines two key aspects concerning access to roadside facilities (18):

Ι	Road connection between regions
II	Road connection between counties
III	Road connection between provinces, villages
IV	Road connection between small villages
V	Road connection between plots and areas

 TABLE 23 Roadway Functional Classification by Types of Connections

TABLE 24 Roadway Functional Category According to Roadside Context

А	No roadside buildings are present
В	Few roadside buildings are present (entering cities)
С	Some roadside buildings are present (suburban, regions within urban plans)
D	Many roadside buildings are present (city centers, residential areas with main function-access)
Е	Many roadside buildings are present (city centers, residential areas, with main function-parking)

1. The distance of the development from the axis (centerline) and the boundaries of the street, when the area is outside the urban plan; or

2. The distance of the building line, as it is defined by the street plan, if the area is within the urban plan.

The design of the connection of the proposed development with the roadway that serves it depends on the administrative category of the street (18). The same design applies when choosing the road connection type for areas outside and within the urban plan. Additionally, parking studies must be approved by the relevant authority according to technical specifications and other criteria for connections to land uses having up to 30 parking spaces that are located within an urban plan area (19). For uses having more than 30 parking spaces, the distance of the development access from traffic lights or another intersection that is considered to be important, is obligated to be larger than 30 m (16).

Large parking areas must be approved by the Ministry of Infrastructure, Transport and Networks. Approval considerations include:

- The function of the road providing access to the parking spaces to be constructed;
- The traffic volume of the road during peak hours (existing-expected);
- The entrance-exit location of the parking space;
- The impact on the level of service of the affected intersections; and

• The impact on the operation of schools, playgrounds, nursing homes, and generally areas of social welfare.

Proposed developments with 200 or more parking spaces require the completion of a traffic impact study. There is no strict standard as to the content of the study or the manner in which it is performed. The quality of the study is generally dependent on the competence of the designer and the available traffic data.

The government body responsible for monitoring traffic impact studies varies depending on the type of roadway serving the proposed development. This fragmented administrative structure makes access management application challenging. It is as follows:

• Roadways within the primary national network are the responsibility of the Ministry of Infrastructure, Transport, and Networks.

• Roadways within the secondary national network are the responsibility of the prefecture.

• Roadways within the tertiary national network are the responsibility of the municipality.

• For proposed developments within the urban planning boundary with 30 or more parking spaces, the Directory of Traffic within the Ministry of Infrastructure, Transport, and Networks is the responsible authority regardless of the roadway classification.

DESIGN, LOCATION, AND SPACING STANDARDS OF ACCESS POINTS

Access points are only defined in Greek law in the following cases:

- For gas stations outside the urban plan; and
- For the areas outside the urban plan, access control is required for all type of uses,

apart from single-family residential.

For areas within the urban plan, access control is required for uses with parking lots of 30 spaces or more (15, 16).

According to the road where the gas station is located, the access is defined and certain standards are set, as shown in Table 25 according to Figure 37, Figure 38, Figure 39, and Figure 40. Apart from the data below, Greek law defines some design and construction standards, referring to the width and length of the driveways, as well as how median openings in the specific location should be built.

Access Type	Туре А	Туре В	Type C	Type D
Roadway administrative category of the accessed roadways	Main national road network	Secondary national road network	Tertiary national road network Main suburban road network Service roads wider than 7 m National road network of the Greek Islands (apart from Crete, Evoia, Rhodes, and Corfu)	Secondary road network Service roads 7-m wide or less Suburban road network of the islands (apart from Crete, Evoia, Rhodes, and Corfu) In certain parts of the tertiary national road network
Special plot requirements	The size of the plot side that has direct access to the road, should be at least 80-m long	The size of the plot side that has direct access to the road, should be at least 50-m long	The size of the plot side that has direct access to the road, should be at least 40-m long	Void

 TABLE 25 Access Point Design Criteria in Greece



FIGURE 37 Access Type A.



FIGURE 38 Access Type B.



FIGURE 39 Access Type C.

LAND DEVELOPMENT REGULATIONS

In Greece, land development regulation is addressed differently according to the two area types already mentioned—areas within and outside the urban plan. Both area types have different regulations when it comes to land development, building permits, and, to some extent, basic access management rules.

CORRIDOR MANAGEMENT POLICIES AND PROJECTS

No corridor management policies or projects are legislated at the moment in Greece, although some research and proposals have been made.


FIGURE 40 Access Type D.

TRANSPORTATION PLANNING AND FUTURE ROAD PLANS WITH THEIR TIMEFRAME

The general master plan for each area in Greece consists not only of drawings and plans regarding urban planning of the area, but also of transportation network plans and future plans. Mostly these proposals should be established within a 10-year span. Beyond that period of time, there are legal problems in implementing or realizing the accepted urban plan. Opposition to the plan and associated land acquisition costs typically occur in such a case.

EDUCATION AND TRAINING

No specific formal programs exist that inform students, professionals, residents or even organizational and administrative parties about access management. Access management is not taught at transportation planning schools or urban planning schools due to a lack of available curriculum credits. In the European Union's Higher Educational area, 30 educational credits are allowed per semester. This limitation does not allow for incorporating the concept of access management into the current transportation curricula at least at an adequate educational level. However, through seminars and conferences the issue is made known to all relevant stakeholders.

SPECIAL AND COUNTRY-SPECIFIC ACCESS MANAGEMENT ISSUES

Most access management problems are found in built-up areas, were no space remains to create the design and environment for the control and management of access. This problem may

become especially acute within the urban plan of city centers, where the building line and plot limits are the same.

Moreover, only in recent years have parking spaces been made mandatory for each new building. Buildings built before 1987, which represent most of the built-up area of Greek cities, do not have parking areas. As a result, streets are filled with parked cars or suffer from constant traffic jams. This is not the case for areas outside the urban plan, where plots are larger and parking spaces can be installed without major difficulty.

Lastly, there are gaps in the legislation and procedures for obtaining a building permit and requiring a traffic design study. There are no manuals or guidelines that architects or urban planners can use and follow to control access and consequently design it properly.

PERSPECTIVES

Prospects for further development of the access management concept are generally good in Greece, despite current economic difficulties. The concept is known to the main stakeholders, understood and its benefits are appreciated. The existing social and public acceptance hurdles are not different than those found in other countries like the United States. Established policies resulting from the experience of other countries, as well as additional initiatives from the state to incorporate an access management scheme into the current land development process, will mitigate the existing hurdles.

COUNTRY REPORTS

Poland

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BACKGROUND

The issue of access control in Poland originated with changes in the economic model and growth of private development investments after 1990. Awareness of the inadequacy of the road network and the desire for improved development access led to expansion of a system of higher roadway classes to serve the rapid economic growth. Yet lack of attention to access control combined with residential expansion along regional and even national roads undermined efforts to establish a hierarchical roadway network.

Beginning in the 1990s, design guidelines were enacted that served as the first regulations relative to access control. These guidelines were revised in 1995 and again in 1999 relative to certain roadway classes (S and GP). These geometric design guidelines used in the 1990s included only "soft" access management regulations for roadways designated as express roads and main fast roads, as access was classified as completely restricted, partly restricted or entirely unrestricted. Numerical values were not provided.

Guidelines enacted in 1999 included more detailed regulations concerning permitted road connections and values for minimum distances between intersections or interchanges. Service of direct surroundings from motorways and express roads is now completely restricted. For main fast traffic roads (GP), access control policy is strictly enforced with regard to distances between intersections and interchanges, although regulations are still rather soft for residential and field access. Therefore, there are still rather imprecise descriptions of possible access to road surroundings (driveways). In general restrictions related to main roads (G class) are not used in practice. These roads are national roads whereas other roads are under regional and local administration almost without any access restrictions.

STATUTORY OR ADMINISTRATIVE RULES AND CODES

According to the law in Poland, there are two classifications of public roads: administrative and technical. Administrative classifications of road networks used for management divides roads into: national roads, regional roads (under regional administration) and local roads (county and municipal administration). In Poland, the total road network is about 384,000 km in length and includes:

- National Roads and Motorways Administration (DK), 18,500 km of national roads;
- Sixteen Regional Roads Administration, 28,500 km of regional roads;

• Local Roads Administration—337,000 km—two types of local roads (road class G and lower); and

• Municipal administration and internal roads, which are not always public roads according to Roads Act (Ustawa o drogach publicznych), 210,000 km.

Despite these administrative classifications, only the Ministry of Transport is responsible for design, traffic rules, and codes, whereas administrators of national roads are responsible for implementation of access management rules. In fact, hard access management rules are only applied in practice to national roads (classes A, S, and partly GP). Administrators of regional roads strive to decrease the impact of poor access control regulation on traffic progression and safety. Unfortunately, the road administration has not had an impact on development of roadways and surrounding land use. Access is restricted by requirements for following technical classes of roads:

- Motorways (A),
- Express roads (S),
- Main fast traffic roads (GP),
- Main roads (G),
- Collector roads (Z),
- Local roads (L), and
- Access roads (D).

Access management is specified by acts, regulations, and guidelines mentioned below, however these records are ambiguous. In practice, there is no uniform formal term referring to road access management, either in terms of road connections or access to the surrounding area.

According to the Road Act (Ustawa o drogach publicznych) (20) roads are classified into two categories as it relates to access: (1) roads with full access (for all users); and (2) limited access roads, including motorways and express roads. According to the Road Act, access to adjacent land should not be restricted except for motorways and express roads. However, in "Technical design standards for public roads and their management" (21) there are requirements for possible road connections, minimal spacing between interchanges or intersections (numerical values) and also requirements for use of driveways depending on the road class ("soft" requirements).

A broader aspect of access control is addressed in the official comments regarding the technical design standards for roadways and their management (22). These comments should be taken into consideration in local land planning for the management of roadway corridors.

The Planning and Land Use Act (Ustawa o planowaniu i zagospodarowaniu przestrzennym) (23) states that local land management plans should be discussed and agreed on with the relevant road authority, whenever the development of land adjacent to a roadway may affect the road. The Planning and Land Use Act also addresses the need to control the provision of access to a plot from a public road. However it does not precisely describe how such access control should be achieved.

The lack of clear legal regulations concerning access of roads results in a common practice of locating buildings along the existing higher class roads, except A and S classes. Since 2010, the National Road Administration has been trying to enforce the "hard" access control

rules used for motorways and expressways to new roads of GP classification. With regard to other road classes, access is practically unlimited.

ACCESS PERMIT PROGRAM AND PROCEDURE EFFECTIVENESS

In Poland, every plot located along a public road has a statutory right of direct access to the public road (23). The law does not state how such access should be realized (i.e., directly or by constructing a service road or other parallel road). A lack of funds, gaps in legal regulations, different road authorities (national and regional road administrations), and historical practice (the sizes and the way plots are divided as shown in Figure 41) have all resulted in common linear development along roadways in Poland. Service roads, such as frontage roads, are built only along new A, S, and GP class roadway alignments.

On the request of the applicant who wants to connect a plot to an adjacent public road, the road authority provides technical conditions (requirements) describing the realization of access points. The road authority decides on the type of access point, (e.g., intersections of various types, individual residential or public driveways with or without additional lanes, etc.) depending on the planned development. The road authority is obliged to permit such access point when the designed access point complies with requirements in the regulations (21).

Because of common land fragmentation in some parts of Poland, especially adjacent to major roads, any attempt to impose stricter access control is difficult and expensive. As a result of ambiguous and "soft" regulations, access control for GP and lower class roads is practically impossible. Effective road access control is performed only for A and S class roads.

DESIGN, LOCATION, AND SPACING STANDARDS OF ACCESS POINTS

Access to roadways is regulated by technical design standards and guidelines (21, 22). Standards and guidelines determine conditions for connections to roads, minimal distances between interchanges or intersections, and conditions for building of individual driveways and other access points depending on the road class (Table 26).

The given access management rules were introduced in Poland in 1999 but actually only some GP category roadways comply with the access requirements. In terms of function, these roadways are similar to minor arterials and collector roads in the U.S. classification system (24). Usually in Poland these roads have 1x2 or 2x2 lane cross sections.

Regarding the design of access management elements, there are guidelines in Poland for intersection design, but only for national roads. These guidelines are recommended for use in other road categories. The guidelines are contained in regulations that also include design parameters for driveways in terms of width of the driveway and abutting roadway, maximal longitudinal grades, the way it is connected with roadway edge depending on the cross-section type and driveway type, rounding radii, and taper at the roadway connection (21).

Legal regulations for driveway design refer only to the section located in the roadway right of way. Design requirements for the remaining section are described in other legal regulations relative to technical design regulations for buildings and their location. There are only two categories of driveways in Poland: individual (residential, housing properties) and public (to other lands and buildings).



FIGURE 41 Example of land use and division patterns in Poland.

ROADWAY FUNCTIONAL CLASSIFICATION AND ACCESS

Table 26 gives the impression that access restrictions are described in detail. However, notations describing access restrictions given in the last column and related to roads of class G and even class GP are not precise and their use depends on the policy of the road administration, which is strict for roads designated as GP. More precise notations for access control are needed in light of strong pressure from investors for road access. The weakness of the access policy is exemplified by the frequent allowance for new public buildings having access without turning lanes from main road.

As a result, only a limited part of the Polish road network can be characterised as having a hierarchical structure with corresponding levels of access control. This hierarchical system is used in practice in constructing street networks in urban areas. For rural roads, the hard rules mostly apply to A and S class roads, and partly to roads of GP class and newly built bypasses.

		Accessibility to the Road ^a			
Class of the Road	Road Location ^b	Intersections or Interchanges with Roads of the Class	Intervals Between Intersections or Interchanges	Service of Direct Surroundings and Access to It	
Motorway, A	R, T	G and roads of higher class	\geq 15 km, and near or within town limits \geq 5 km, (\geq 3 km)	No service of direct surrounding:Stop of vehicles on designated lay-bys only,	
Express road, S	R	G (Z) and roads of higher	≥5 km (≥3 km)	 (a lay-by is a place at the side of a road where a vehicle can stop for a short time without interrupting other traffic) and No driveways to properties. 	
	Т	class	3 km (≥1.5 km)		
Main, fast traffic road, GP	R		≥2 km (≥1 km)	Limited service of direct surroundings:Stop of vehicles on lay-bys or on stop lanes separated from the roadway with maneuver	
	Т	(L), L, O, OI, S, A	≥1 km (≥0.6 km)	 lane and Driveways to properties acceptable by exception. 	
Main road, G	R		≥0.8 km (≥0.6 km)	 Limited service of direct surroundings: Stop of vehicles on lay-bys or on stopping lanes and Limited number of individual driveways to properties. 	
	Т	(D), L, Z, G, GI, S, M	≥0.5 km (≥0.4 km)		
Collector road, Z	R		≥0,5km (≥0,25km)	 Partly limited service of direct surroundings: Stop of vehicles on lay-bys or on stopping lanes and Recommended limitation of access points to properties. 	
	Т	D, L, Z, O, OI, 5	≥0.3 km (≥0.15 km)		
Local road, L	R T	D, L, Z, G, (GP)	Not defined	The service of direct surroundings should not be limited if road regulations are complied with.	
Access road, D	R T	D, L, Z, G, (GP)	Not defined	The service of direct surroundings should not be limited if road regulations are complied with.	

TABLE 26 Control of Access to Roads in Polish Guidelines, 1999 (21)

 a^{a} (...) = values permissible by exception. b^{b} R = roads in rural areas; T = roads in built-up areas.

ACCESS CONTROL METHOD ON FREEWAYS

In Poland motorways and express roads, being roads with limited access by law (20), are protected from excessive levels of property access. Legal requirements address suitable minimum spacing between interchanges and intersections, especially on express roads (21). Direct access to the road by abutting properties is legally forbidden (except for rest areas) for any investment after 1999.

LAND DEVELOPMENT REGULATIONS

In Poland, legal regulations concerning land use, are provided in the Planning and Land Use Act (Ustawa o planowaniu i zagospodarowaniu przestrzennym) (23). This act states that local land use plans should be discussed and agreed upon with the relevant road authority whenever the development of land adjacent to a roadway may affect traffic or safety and operation of the road itself. The act addresses the provision of access from a plot to a public road, but it does not precisely describe how access management should be achieved.

In local land use plans, the category of plots and development requirements are precisely defined. In case of a lack of such data, which is the case in many municipalities, each investment is considered individually and individual requirements for investment are prepared. Also, the way in which the plot connects to the public road must be determined in consultation with the road authority.

CORRIDOR MANAGEMENT POLICIES AND PROJECTS

There are some plans to implement corridor traffic management for sections of motorway through the Silesian region and certain segments of express roads entering Warsaw.

TRANSPORTATION PLANNING AND FUTURE ROAD PLANS WITH THEIR TIMEFRAME

Poland is carrying out a program of motorway construction (two east–west and one north–south motorway), which is scheduled for completion in 2015. Additionally, development of a network of express roads is being scheduled (two formerly planned as motorways). Also, bypasses of small towns and villages on one- and two-roadway roads of GP and G class are being planned. Other programs to upgrade the existing road network are underway, mainly involving a change in cross section [e.g., cross sections of 1x2 lanes with paved shoulders into 2+1 cross sections or into sections with multifunctional middle lanes (continuous two-way left turn lanes) and some traffic calming measures on parts of roads through towns and villages]. On regional roads, bypasses are being constructed and existing road network are being modernized.

EDUCATION AND TRAINING

Currently, no training on access management is in progress.

SPECIAL AND COUNTRY-SPECIFIC ACCESS MANAGEMENT ISSUES

The partial regulations regarding access control in Poland (21) may be regarded as the first step towards access management. It is expected that further steps towards introducing a wider access management scheme will be included in the next update of the regulations. However, changes to land use regulations will also be needed in this regard.

Analysis conducted in five Polish regions as to the degree to which national roads (GP and G class roads) are built-up indicated that, depending on the part of the country, from 22.6% (Wielkopolskie Province) to 42.8% (Małopolskie Province) of these roads pass through built-up areas, thus becoming multifunctional roads with an increased road safety risk. Also, outside built-up areas, there are road sections with an increased accident risk as a result of the high density of intersections, public and individual driveways. Therefore, it is necessary to take appropriate action to transform the road network in order to comply with Poland's "requirements of health protection and public safety..." (23).

These actions include some at the planning stage and also at the detailed design phase for road infrastructure. Efficient access management can best be applied on new road sections of A, S, and GP classes. Improving access on existing roads is highly difficult and expensive because of surrounding development. Therefore, the following questions need to be answered:

• To what extent is it feasible to accommodate different functions of roads through small and medium-size villages while maintaining good traffic progression and safety?

• How should the new roads be designed to combine different functions, and how should the existing roads be transformed?

• In what cases is it necessary to separate different road functions, for instance, by building bypasses or additional road links for local traffic?

In order to reply to those questions, tools, like models quantifying the influence of road features and their surroundings on traffic accidents and traffic flow progression, are necessary. Such models will allow predicting the expected changes in road safety as a result of introducing various treatments for road safety improvement, including limited access and changes in the development of road surroundings.

Due to specific Polish conditions foreign data can be used only in a limited extent. Polish roads are characterized by varied levels of surrounding land development and the lack of a hierarchical roadway structure. In recent years, building along roads intended for through traffic movement has intensified due to decentralization of big cities and suburban development. Many sections of national roads, with extensive through traffic, have been built up and housing and commercial buildings have direct access to them. The traffic generated by servicing the road surroundings leads to traffic flow interruptions on main roads and may result in road accidents. High densities of driveways, entries, and exits are potential crash points (also pedestrian–vehicle crashes) and cause more frequent deceleration, stops, and accelerations. Those interruptions

depend not only on road access, but also on the nature of development surrounding the roadway. More intensive development generates additional traffic resulting in higher crash risk exposure.

The following problems associated with access management are observed in Poland (Figure 42):

• Large share of sections (over 30%) located in built–up areas;

• Low level (or lack) of road network hierarchy and multifunctionality of several roads often related to unrestricted access;

- Lack of service roads and commercial facilities located along the national roads;
- Linear development along the roads of different types and intensity;

• Use of safety measures for vulnerable road users made more difficult by linear development and its dispersion; and

• Departure from the requirements of Polish technical classifications for roadway access control (21) on nearly 50% of the national road sections located in small communities and suburban zones (Figure 43).



FIGURE 42 Example of typical development and use of road surroundings on Poland roadways intended for through traffic movement.



access density in built-up areas.

COUNTRY REPORTS

United Kingdom

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BACKGROUND

Access management in the U.K., as in many other countries, has been very closely tied with road safety. The latter has been a concern since the introduction of motorized vehicles, and became paramount with mass motorization from the 1950s onwards and the corresponding surge in traffic accidents (1965 was the year with the highest peace-time road fatalities). Of particular importance was the protection of pedestrians, who, being more vulnerable, faced greater risk of suffering injury or death. This was pursued by means of their segregation from vehicular traffic, which, dating back at least to the work of Le Corbusier in the 1930s, relied upon the design and implementation of structures including pedestrian subways and bridges, pedestrianized areas, as well as guardrails and walls separating pedestrian pathways from the road, which in turn was reserved for vehicles.

With the car gaining popularity and becoming the prevailing travel mode, and with pedestrians being safely kept away, access management in the U.K. was for many years considered only from the perspective of motorized traffic. The resulting "parallel universes" of vehicles and pedestrians had very few contact points, and hence access management challenges were only found with respect to ensuring unobstructed traffic flows to bring vehicles to these contact points. The concept is set out most lucidly in Buchanan's *Traffic in Towns* report (25) of 1963, which served as a street design manual in the U.K. for many decades (Figure 44).

In recent years, however, there has been a trend away from traffic segregation, driven by developments in architecture and urban planning. Segregation has been deemed by some detrimental for urban environments due to its perception as resulting in "the domination of



FIGURE 44 Segregation of vehicles and pedestrians from Buchanan's Traffic in Towns (25).

vehicular traffic and associated noise and air pollution alongside street clutter and ugly surroundings" (26). Instead, road design has shifted gradually towards the concept of "shared space" as a means of creating a better public realm, mainly by asserting the function of streets as places rather than arteries and designing more to a scale aimed at easier pedestrian movement and lower vehicle speeds. This has introduced a new dimension to access management in the U.K., which has shifted from its traditional car-oriented focus and is now based on designing inclusively for all road users and particularly vulnerable ones (pedestrians and cyclists). New highway design guidance by the Department for Transport (DfT) supports this trend, particularly through the recently published two-part *Manual for Streets* (MfS) (27–29), and the Local Transport Note (LTN) 1/11 *Shared Space* (29).

Elaborating more on the term shared space, and conversely to popular belief, this is not used to characterize entire streets and places as shared or not shared, particularly given that streetscape design cannot be standardized and needs to be context-sensitive. Instead, shared space is used as an umbrella term to collectively refer to a range of streetscape treatments, aiming at creating a more inclusive public realm, which promotes place-making through effective access management to the surrounding land uses. These may range from the removal of obstructions (e.g., de-cluttering) and the introduction of informal (uncontrolled) pedestrian crossing facilities in a traditional kerbed street layout, through to layouts with a single surface and little or no delineation between pedestrian and vehicle areas (30-34).

While early examples of shared space included mainly home zones in residential areas, in analogy to the Dutch "woonerf" principle, more recent examples are not confined to residential environments and are gradually being introduced at several locations around the country. High-profile schemes have been implemented in London (notably Oxford Circus, Piccadilly Circus, Kensington High Street, and Exhibition Road, Figure 45), but also in other cities (such as Brighton, Bristol, and Ashford). These are also accompanied by numerous smaller-scale schemes involving more basic treatments, such as the removal of guardrails and the introduction of lower speed limits.



FIGURE 45 Exhibition Road before (*left*) and after (*right*) redevelopment.

LEGAL FRAMEWORK

The level (national, regional, local) at which access management in the U.K. is undertaken depends on the authority managing the road or area in question. The underlying legal framework for controlling or managing access along various roads and areas consists mainly of so-called Traffic Regulation Orders (TROs) under the Road Traffic Regulations Act (RTRA) 1984 (*35*). TROs are introduced to manage access and traffic at specific locations or as part of larger traffic management programs, and relevant transport authorities are empowered under the RTRA 1984 to issue them so as to implement particular policies and schemes.

ROADWAY FUNCTIONAL CLASSIFICATION AND ACCESS

The traditional classification of roads in the U.K. includes M (motorway), A and B roads at the national level, and minor roads at the local level, which may be further classified into lower categories by the relevant local authority on an ad-hoc basis. Roads are also broadly designated as trunk or nontrunk. The former (also called primary route network) are the responsibility of the Highways Agency in England, Transport Scotland in Scotland, the Department of Economy and Transport in Wales, and Transport for London in the particular case of London; the latter are under the jurisdiction of local authorities (county councils or London boroughs).

It has been recently recognized, however, that the traditional classification is limited as to its consideration of only the function of movement for roads. As such, in the newly published MfS (27–28), a new classification complementing the traditional one has been introduced; this is based on what is termed the context of roads. Namely, a disambiguation between streets and roads is first made, where a street is defined as "a highway with important public realm functions beyond the movement of traffic, which has a sense of place," whereas a road is defined as "a highway whose main function is to accommodate the movement of motor traffic." Following that, the context of roads and streets is defined according to the relative importance of their movement and place functions. Road categories (or context types) are defined in Figure 46.

It is pointed out, however, that standard classifications are to be used with caution, as they fail to take account of the changing context of streets and roads.

ACCESS CONTROL SCHEMES

A number of access control schemes have been implemented in the U.K.. Examples include many small-scale schemes, such as prohibiting certain vehicle types in certain locations by means of explicit (e.g., dedicated barriers, bollards, road width reductions) or implicit physical measures (e.g., creation of safe spaces through seating, plants, and other features), as well as by means of operational measures (e.g., traffic signals) measures. There are also some large-scale schemes, such as the London congestion charging scheme, and the London low-emission zone scheme.



FIGURE 46 Street and road classification (27–28).

Access control schemes are implemented primarily at the local level. Regulations are provided by means of guidance documents by relevant authorities, such as the DfT's Traffic Advisory Leaflet (TAL) ITS 6/03 Access Control of 2003 (*36*).

LAND USE REGULATION

U.K. legislation regulates road abutting land uses and development through Sections 247, 248, 249, and 251 of the Town and County Planning Act (TCPA) 1990 (*37*). A zoning scheme is in place, such that the provision of access to different land uses is underwritten by relevant rules.

ENFORCEMENT SCHEMES

The regulations of the TROs under the RTRA 1984, and of the relevant sections of the TCPA 1990, provide adequate legal backing to transport authorities to enforce relevant access control and land use schemes.

POLICIES AND STANDARDS

Access management practice in the U.K. is supported by guidelines for highway design from the DfT. For trunk roads and motorways, the respective guidance is the *Design Manual for Roads and Bridges* (DMRB) of 1992 (*38*), and more specifically Volume 6 (Road Geometry), which is split in three sections (Links, Junctions, Highway Features). Access management is considered explicitly in Section 3 (Highway Features), where it is covered in a dedicated chapter, and where it is pointed out that accesses pose potential safety hazards, and that their number and frequency should be therefore kept to a minimum.

In the absence of any additional guidance, the DMRB was also used in the design of urban streets for many years, alongside *Design Bulletin 32: Residential Roads and Footpaths–Layout Considerations* (DB32) of 1992 (*39*) and its companion guide *Places, Streets and Movement* of 1998. Nevertheless, this guidance admittedly failed to capture the fact that urban streets differ from trunk roads, in what they additionally have other functions apart from movement. As such, following work commissioned by the DfT, the Department for Communities and Local Government, and the Commission for Architecture and the Built Environment, the MfS was published in 2007 (*27*). Its purpose was to provide guidance for the design and redevelopment of primarily residential streets, in order to make it more people-oriented. MfS was complemented in 2010 by *MfS 2: Wider Application of the Principles (28)*, to bridge the gap between MfS and the DMRB, extending the principles of MfS to busier nonresidential nontrunk roads with an important public realm function. The relationship between MfS, MfS 2, and the DMRB is demonstrated in Figure 47.

The management of accesses is explicitly considered in a relevant chapter of MfS, and it is stated that, in contrast to the traditional approach of minimizing the number of junctions, crossings and accesses to accommodate more traffic, these should be now seen as "opportunities for place-making," and should be encouraged. In particular, properties are encouraged to directly front on the street, as this links the street to its surroundings and contributes to the quality of the public realm.

In addition to the three main manuals, the DfT has published a number of further guidance documents in the form of LTNs. Of particular importance to access management is LTN 1/11 *Shared Space (29)*, published in 2011, which provides a definition of shared space and extends the MfS principles to the design of shared space schemes.



FIGURE 47 Coverage of MfS, MfS 2, and the DMRB.

MODES ADDRESSED

Access management and control rules are in place for pedestrians and cyclists. These are documented in a number of DfT guideline documents, in addition to MfS and LTN 1/11, namely *Inclusive Mobility: A Guide to Best Practice on Access to Pedestrian and Transport Infrastructure* of 2002 (40); TAL 5/05 *Pedestrian Facilities at Signal-Controlled Junctions* of 2005 (41); LTN 3/08 *Mixed Priority Routes: Practitioners' Guide* of 2008 (42); LTN 2/09 *Pedestrian Guardrailing* of 2009 (43); and more recently LTN 1/12 *Shared Use Routes for Pedestrians and Cyclists* of 2012 (44).

Access management measures for pedestrians and cyclists are aligned with the recent trend of inclusive street design, which caters for the needs of all road users. Examples include the removal of guardrails, the provision of cycle lanes and paths, the implementation of mixed-use routes, and the application of lower speed limits for car traffic. Access to public transport facilities is also addressed, with a range of measures being recommended in multiple sections of the various guidance documents.

PERSPECTIVES

The new U.K. approach for street design, which addresses the issue of access management, has brought about two main changes.

• The first change is that the new approach has marked a shift in thinking. It has converted the issue of access management from an exclusively car traffic matter to an issue affecting all road users, and particularly the vulnerable ones. The new thinking does not assume that travelers reach destinations only by car, and hence does not focus only on how to ensure access for cars, but accounts for the needs of pedestrians and cyclists (e.g., soft modes), but also for the integration of public transport in design.

• The second change that the new approach has brought is the explicit consideration of the place function of roads, in addition to the traditional movement function. The approach now involves designing inclusively and creating better spaces that people would want to spend time at, rather than high-capacity roads to accommodate growing traffic demand.

A dedicated access management guidance document or manual, however, is still missing from the U.K. scene. The development of one in the near future would more comprehensively conceptualize the access management principles, thus offering a valuable tool to transport planning practitioners and authorities.

COUNTRY REPORTS

Australia

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BACKGROUND

The Australian road transport and traffic authorities' interest in access management began in the middle 1990s. This led to the first national guidebook, *A Framework for Arterial Road Access Management*, in 2000 (25). Since then, the industry has moved to simplify the planning process and reduce the number of agencies involved in the issuing of development permits. The different practices among states and local councils have led to a range of outcomes in how access is permitted and designed (45).

This initial framework has been updated multiple times since and incorporated into the *Austroads Guide to Traffic Management* set of guidebooks. Its latest incarnation was published in 2014. This framework for arterial access management provides basic steps and factors for the consideration of access during new road planning, the preparation of development applications and when assessing proposals (46).

Prior to the development of a national guidebook, the practices and legal powers were diverse. The level of development of access management policies was varied among road authorities. The variations in practice at that time included the areas of:

• Degree to which the road classification reflects the access rights and expectations.

• Ability of road authority to incorporate access requirements into planning schemes and long range plans

• Weight given to road authority requirements in the development control process.

• Available documentation setting out rationales, processes and technical requirements for access management.

• Degree of integration between road and land use policies and requirements.

In addition to identifying local benchmark practices, access management practices of Canada and the United States of America also played a role in the development of a framework (45, 47). While there are potentially many variations in detailed practice, access management practice among Australian states and territories follow a broad common model. The approach and mechanisms, as it stands now, incorporates the following basic principles:

• Enabling legislation. In order to preserve the traffic function on roads, the level and nature of vehicular access to sites abutting roads needs defining. In many states and territories there are special categories of road defined in legislation that carry specific access control powers and conditions.

• Provision for limited access roads. Legislation allows for the creation of fully access controlled roads. In detailed practice this power rests with the State Road Authority (SRA) in a majority of states and territories.

• Management and planning techniques. SRAs and local councils have a variety of tools available to them to control the location and type of access points.

• Local councils are the responsible planning bodies. In the states and territories the local councils are typically the responsible planning body for most land use plan preparation and development control.

• Designation of road types in legislation and planning schemes. In some, but not all, cases legislation and planning schemes have access management implications and requirements. The level of involvement by SRAs in the preparation of planning schemes varies.

• Road authorities as planning application referral bodies. Typically land subdivision and site development applications are referred to the SRA in the case of state roads and local government for other roads.

• Appeal rights. In most cases, planning decisions and conditions can be taken to appeal. Appeals may be heard by planning tribunals, appeals courts or by ministers (e.g., Minister of Transport) (45).

There appears to be an understanding of the dual land use and traffic aspects of access planning and management. Overall, official approaches to access management in Australia avoid an overly traffic-oriented emphasis and consider other modes.

LEGAL FRAMEWORK

Broadly speaking, all jurisdictions have legislation covering road functional classification, powers and responsibility of the various road authorities, and the process by which development proposals are considered and determined as well as enforced. For example, the legal framework for access control is embedded in a number of different acts in the State of Western Australian (WA): the *Main Roads Act* (45), the *Road Traffic Code 2000*, and various local government and planning acts (48).

Road Designation for Access Management Decision Making

Some sort of relationship between level of access and road hierarchy is implicit in most Australian approaches and explicit in some. Jurisdictions that have limited access roads or similar legal road categories are clear examples of those with an explicit relationship (45).

For example, the Queensland *Transport Infrastructure Ace 1994* (TIA) provides the SRA (Department of Transport and Main Roads) the power to approve, amend prohibit, or apply conditions to access decisions. This includes access between a state-controlled road and adjacent land. Additionally, the act requires local governments to refer to the SRA any road work or change to the management of a local government road which would have a significant adverse impact on an existing or planned state-controlled road. Finally, the act requires SRA approval before carrying out road work on, or interfering with, a state-controlled road (49).

The key differences in approach between jurisdictions and cases lie in whether or not the consenting authority is required to consider access management consequences, and if any conditions imposed by the road controlling authority are obliged to be included in the development permit (45).

Other than standards applying to limited access roads, there are no found examples of legally enforced, hierarchically related access management standards across a range of road types (45) as are found in many U.S. states.

Provisions for Restriction or Change of Access

There is no uniformity between jurisdictions on whether compensation is payable in various types of cases or not. The arrangements range from no specific arrangements to acts establishing procedures for acquisition and mechanisms for determining compensation. It appears that not every state's law recognizes a general right to obtain access directly from passing traffic lanes, and there is not normally an expectation that compensation is payable when work or other controls prevent direct access to a site (45).

ROADWAY FUNCTIONAL CLASSIFICATION AND ACCESS

Overall, the level of agreed or statutory road classification system that reflects the permitted levels or types of access varies in practice between jurisdictions. Both the application of access controls and the level of road classification vary.

Generally road types are designated in legislation and planning schemes with corresponding access management implications and requirements. However, there are varying degrees of involvement by the SRAs in preparing planning schemes and local road network plans. Similarly, the opportunity for application of access controls in planning schemes and in the development application process varies between jurisdictions.

In the territories, Northern Territory and Australian Capital Territory (ACT), the territory government agencies are the responsible planning body for most land use preparation and development control. In the states, local councils typically serve this role.

The road functional class or hierarchy commonly comes into play in allocating responsibilities and powers for access management. This implies a more intense consideration of access requirements and implications on higher-order roads. Commonly, the SRAs are responsible for implementing access conditions and requirements on state roads and the local government is responsible for all other roads. However, in some states the local government may provide consent or be responsible for implementation of access conditions and requirements on at least some state roads.

The general distinctions between road types for access management purposes appear similar between jurisdictions:

- State-controlled roads and others;
- Functional arterial roads and others; and
- Access-controlled or not.

The number of road types for access management purposes varies between states and territories from 1 to 4. The most common number of types is 4 and those types can be summarized as:

• Freeways, tollways, and motorways;

- Declared limited access roads and primary arterials;
- Other declared roads and secondary arterials; and
- Undeclared roads and local roads (45).

ACCESS CONTROL SCHEMES, POLICIES, AND STANDARDS

Each state and territory has specific guidelines and standards for the location and nature of access points. The level of detail related to access type, spacing, and design provided varies among jurisdictions. There appears to be little commonality in coverage and detail between the jurisdictions. A set of standardized parameters and technical dimensions have yet to emerge. In general, the guidelines fall into two broad categories: road-based standards, and land use or subdivision planning guidelines (45, 50, 51).

As is typical among most Australian states and territories, access management in WA is controlled largely by the proclamation of the road where a road is declared either with or without control of access and the state classification of the road. Generally speaking, control of access is only proclaimed on state controlled highways. Other general access control is a function of transportation and urban planning and largely controlled by local governments and the planning commission (45, 50).

Since the initial framework and guidebook, there has been an increased emphasis on access management in documentation for developers in some states. The key difference in schemes between jurisdictions and cases lie in whether or not the development approving authority is required to consider access management consequences, and whether or not conditions imposed by the road controlling authority are obliged to be included in the development permit (45).

Several considerations impact access management decisions that would be expected, including:

- Planning scheme requirements, local planning standards, etc.;
- Driveway location and design;
- Road functional class and hierarchy;
- Environmental and heritage guidelines;

• Engineering and design requirements (e.g., sight distance and interference to through traffic); and

• Median-opening spacing (45, 50, 51).

Design standards for roadway features are typically handled at the state level, with some local councils having additional design standards especially as they relate to driveways. For example, the primary set of design standards for roadway features, such as deceleration taper and length are generally provided in state guides, whereas driveway design requirements are set at the local council level.

FREEWAY SERVICE CENTERS

Freeway (motorway) service centers often receive special consideration by jurisdictions. These sites have direct ramp access from a freeway or other road with high levels of access limitation, which provide fuel, food, and other services to motorists. Standards and practices vary on the spacing and design of these facilities (45). For example, in WA the *Development Control Policy* includes a special section to proposals to establish freeway service centers on land abutting a primary regional road right-of-way in the metropolitan region scheme or a regional planning scheme where a road is planned to be developed to a freeway standard (50).

LAND USE REGULATION

Land use in Australian states and territories is generally controlled by a state-level planning commission and local governments. For example, in WA land use is controlled by the WA Planning Commission and local governments (36). The SRA generally has some influence on the process by being able to comment to the local government on proposed development applications and proposed planning scheme amendments (50, 51).

The degree of integration between road and land use policies and requirements varies in practice between jurisdictions. However, it is apparent that an integrated approach is regarded as necessary in the access management process. It is the intention to include an integrated approach, with varying degrees of implementation to date, of most state and local planning systems in place in Australia (45).

ENFORCEMENT SCHEMES

The framework for administration and enforcement is provided in the state acts and local planning guides. Legislative powers seem to focus largely on access control (45).

As previously discussed, there are no examples of legally enforced hierarchically related access management standards in Australia other than standards applying to limited access roads (45). This, along with the lack of integrated road and land use policies potentially creates several challenges and controversies related to enforcing access management guidelines and standards as well as uniformity.

Among the Australian states and territories, the mechanisms for access management practice differ in the weight given to road authority requirements in the development control process. Additionally, the availability of documentation that sets down the rationale, processes and technical requirements for access management varies (45).

MODES ADDRESSED

While historically focused on the automobile, local governments and SRAs do consider all modes as part of access management. Since the early framework and guides, there have been developments to exploit the potential synergy between access management and the needs of buses, cyclists and pedestrians. This includes examining continuous lengths of routes for

pedestrians, cyclists, buses, and delivery vehicles and identify missing links, conflict points or other potentially difficult locations as part of the development application process (52).

At the time of first national framework document only one of the eight states and territories and a small number of local governments reporting having specific guidelines on the effects of abutting development and access on pedestrians, cyclists, and buses. In most other instances, the impact of access points on pedestrian, cyclists, and buses was reviewed on a case by case basis (45).

More recent national guidebooks have better recognized the relationship and included guidance on pedestrian, bicycle, and bus provisions that focus on the road functional class, posted speed limit, traffic volume, and access management treatments.

PERSPECTIVES

Access arrangements for higher-order roads, including arterials, are of major interest to SRAs. Consideration should be given to ways in which influence over access to these roads can be exercised (45).

The costs of access management are likely to be reduced if there were greater certainty for government and land owners. This calls for appropriate planning to create clear rules and expectations for all stakeholders in terms of the requirements for the location and design of points of access (45).

There is vulnerability of access management arrangements to arbitrary decisions. Procedures and precedents that give access management requirements a higher status in decision making would reduce this liability (45).

Overall, the use and availability of the various planning and traffic management tools for access management varies between jurisdictions. Developing a mechanism or documentation that would compare practice and experience with these techniques between jurisdictions would be useful. Additionally, consideration by each jurisdiction towards the recorded national benchmark practices would help create a more uniform and predictable practice (45).

Utilizing international best practices, as has been done in the past, in the development of guides and frameworks should continue in growing the access management practice in Australia.

It is clear that a holistic and integrated approach is regarded as necessary by SRAs in the access management process, and is the intention of most planning systems in place in Australia. Access policy and specific decisions that are part of an integrated planning process are considered a benchmark practice (45, 47). If carried through, this would bring about advances in transportation planning and access management at the state and local level.

Comparative Review

A ccess management is a strategy to apply access control techniques across all functional roadway levels. Access classification systems create the hierarchy to establish a full range of control from the highest level (freeway) to the local minor streets.

This international survey of access management practices in eight countries has provided some information on the status of access management practices in various nations of the world. It has revealed that nations are in varying stages of developing a concept of access management for further implementation and that there is understanding of the safety and operational benefits of the concept. Beyond that, the practices and degree of integration of access management into transportation and land use planning vary widely.

The United States is currently working toward systemwide advancement of access management practices, with an emphasis on improved roadway network planning for all modes and careful control of access in relation to planned roadway function. South Africa and China are two other countries that are familiar with access management and seeking to expand their access management programs and requirements on a national level.

In some of the other countries, such as South Korea, Poland, and Greece, the concept has been recognized as an important factor in managing land development and is being introduced partially or occasionally, as opportunities arise. However, various reasons hinder further development of the concept in each of these countries, at least for the present. In Germany and the U.K., access management practices are limited and more strongly focused on serving vulnerable road users.

Many of the participants in this survey have become aware of access management through their professional practice or research activities. A broader examination of international practices will likely reveal that a majority of nations are largely unfamiliar with the concept of access management and its benefits. Nonetheless, the building blocks exist in every nation to begin integrating the concept into urban planning and regulation, as well as major roadway planning, policy, and design.

For the various individual aspects of the access management concept in particular the following conclusions could be derived:

LEGAL FRAMEWORK

In the United States, following more than 30 years of consistent and continuous development of access management practices, some states have introduced a strong legal framework that advances access management at all necessary technical levels: planning, design and operation of highways. This is mostly accomplished by codifying access policy in clear state and local standards, regulations, and procedures. An important element of this coding is a clear procedure with discrete criteria for review of deviations from standards to allow appropriate flexibility—an important component of any access management program. China also implements a strict access regulation scheme based on land socialism and public ownership of institutions. The variety and extent of this regulation is not comparable to the one found in the United States due to the existence of a different societal and governmental structure.

Similarly Australia has developed a strong legal basis for implementing an access management scheme. Access control in Australia is embedded in a number of different national laws and various local government and planning acts.

In all other countries reviewed, a relatively small-scale access management program is carried out solely through primary rules, acts or bylaws. These legal tools are associated basically with

- The administration and operation of a functionally classified roadway, which is governed by a national or local competent agency, and/or
 - The building rules or bylaws prescribed in the urban or land use development plan.

Table 27 illustrates the legal framework and tools in the various countries reviewed.

ROAD FUNCTION ASSOCIATED WITH ACCESS MANAGEMENT AND CONTROL SCHEMES

All countries reviewed associate the opportunity to access properties abutting highways with the functional classification of the roadway. Freeways (motorways) in all countries are fully access controlled, while expressways are often only partially access controlled. Intersection spacing,

	Legal Framework and Tools					
Countries	Extent of Codifying AM Standards	Access Point Engineering Standards	Access Permit Procedures	Criteria for Deviations from Standards		
United States	Varies by state	Yes	Yes	Yes		
South Africa	Partially for freeways and arterials	Yes	Yes	No		
China	Full	Yes	Yes	Yes		
South Korea	Partially for freeways and arterials	On an ad hoc basis from U.S. documentation	No	No		
Germany	Partially for all road categories	Partially in urban settings only	Yes	No		
Greece	Partially for freeways and arterials	Partially for specific land uses	In specific cases	No		
Poland	Partially for freeways and arterials	No	Partially	No		
United Kingdom	Partially for all road categories	Yes	No	No		
Australia	Strong	Yes but varying between states and local jurisdictions	Yes for designated roadways	No		

TABLE 27 Legal Framework of Access Management (AM) in Various Countries

signalization rules and divided highway criteria apply for all countries based on traffic engineering criteria and result in intuitive implementation of access control. Beyond those two road categories, the access schemes applied vary from country to country, with most having no access control at all, despite the technical need for access management given traffic volumes and trip generation characteristics of abutting land uses.

In South Africa, three levels of governance define the access schemes applied by each jurisdiction for a given road category. In China, a strict public regulatory scheme defines the road functions and associated access possibilities. In South Korea, the basic access patterns for freeways and arterials are established as found mainly in U.S. documentation, but not systematically implemented. In Germany the general access type restrictions are explicitly written in the urban plan regulations for built-up areas, while for rural roads the corresponding public road law regulates access.

In Greece, a limited number of access control rules apply for arterial highways and streets, primarily based on the lot frontage dimensions of abutting properties. In Poland, direct access to public roads other than freeways and arterials is mandatory; access type and driveway design controls are applied ad hoc for all other road categories. In the U.K., access control for all road categories other than freeways and arterials is provided by the competent local authorities and access control complements the conventional functional category of a road in a "complete street" scheme. Both the complete streets concept and the various road context definitions impose explicit or implicit physical measures, as well as various operational measures, that indirectly affect access type and intensity on U.K. roads.

In Australia, the road functional class or hierarchy does commonly come into play in allocating responsibilities and powers for access management. The distinction between road types for access management purposes are state-controlled roads, functional arterial roads and access-controlled or not. Access management in Australia is controlled largely by the proclamation of the road where a road is declared either with or without control of access and the state classification of the road. Direct control of access is only proclaimed on state-controlled highways. Other general access control is a function of transportation and urban planning and largely controlled by local governments and the planning commission. Special cases in Australia are freeway (motorway) service centers, which often receive special consideration by jurisdictions.

LAND USE REGULATION

All countries reviewed have a strong land use regulatory framework. Zoning and urban design criteria, including master plans, can be found practically in all countries. However, distinct differences exist regarding the extent that access management issues are considered and addressed in land use regulations of the various countries. The most intense land use regulation is found in urban settings.

Beyond the United States and China, the next most-comprehensive land use regulatory framework that encompasses access management is found in South Africa. The other countries present a strong legal basis for addressing access management in land use and development, but primarily address access issues in a partial or ad hoc manner.

For corridor development, access management related criteria are addressed formally in the United States and partially in Poland in the Silesian region. Such limited application is surprising given that corridor planning is known to the transportation planning community in all countries, is mentioned in research or hearings, and is addressed occasionally in individual planning efforts.

In light of the widespread application of land use requirements, incorporating access management criteria into existing land use legislation could go far in advancing the concept in countries that lack a formal background for access management.

ENFORCEMENT SCHEMES

Direct enforcement schemes for access management are provided in the United States and China and to some extend also in South Africa and Australia for designated access controlled roadways. All other countries have an enforcement scheme that requires permission for access connections to roadways from adjacent properties. The scheme is indirectly and partially applied through urban planning or land use regulation in conjunction with the functional classification of the corresponding roads. Here again, urban planning or land use legislation offers an opportunity for advancement of the access management concept in the countries reviewed.

POLICIES AND STANDARDS

The TRB *Access Management Manual* (2003, 2014) provides technical guidance and although it is not an official standard or policy, it is a widely respected resource that is consulted by agencies in the United States and abroad as they develop or update access management policies and roadway design manuals. China translated the first edition TRB *Access Management Manual* (2003) and is actively conducting research and working to advance the concept. South Africa prepared national access management guidelines and guidance, although these have not yet been fully implemented. Volume 6 of the U.K. DMRB on Highway Features explicitly refers to access management.

In other countries reviewed, highway design or land development manuals exist and contain rules for intersection spacing and functional classification of roads as well as land subdivision instructions. Of these countries, Germany and Greece provide explicit procedures for a limited number of driveway designs. Germany also has an access permit procedure. In South Korea, access management is practiced either through land development projects or by the occasional use of the TRB *Access Management Manual* (2003, 2014). In Australia the 2014 *Austroads Guide to Traffic Management* guidebooks provide the basic documentation for access control policies and rules for designated roads at a state level, while local jurisdictions have a non-uniform approach to access control policies and standards (Table 26).

TRANSPORT MODES

A multimodal approach that is indirectly associated with the concept of access management can be found in Germany, the U.K., and recently in Australia. In the United States, the auto-oriented access management approach is transitioning to a multimodal one. When completed, it will represent the only comprehensive multimodal access management approach worldwide. All other countries examined have design policies that include pedestrians, cyclists and in some cases also transit and freight, but without any direct association or reference to access management or control.

PERSPECTIVES

The perspectives of developing or simply advancing the concept of access management vary considerably between the countries examined, ranging from promising to discouraging. In the United States, the highly developed concept of access management, with its beneficial roadway safety and operational effects, is being expanded to include all road users in the corresponding analyses and design solutions. Incorporating sustainability and livability into access management decision-making remains a high priority for the United States in the immediate future.

Another promising case of advancing access management in highway design and land development processes is presented in South Africa. Access management techniques and tools are presented in manuals and corresponding efforts are focusing at tackling the hurdles and difficulties associated with implementation of the concept. These efforts primarily target actions to achieve improved alignment of access spacing criteria with the functional classification of roads and streets, as well as overcoming difficulties in applying access management standards due to current land development conditions.

China is also striving to implement a successful access management scheme. The Chinese approach will take bicyclists under consideration as a special design mode and will adjust conditions to the specific demands of Chinese urban development.

In South Korea, despite widespread awareness of the benefits of access management among design and planning experts, strong and widespread implementation of the concept is currently impeded due a general national policy of deregulation in planning and development programs. The Korean transportation and planning community will need to persuade decision makers as to the benefits of access management for the economy, livability, and safety of the general public.

Prospects for developing an access management process also appear limited in Germany, due to existing legislation and long-established development patterns. A major hurdle lies in the lack of awareness of the concept among the transportation and planning community. Strong road design and extensive traffic engineering measures, coupled with sustainability and livability planning activities at all decision levels, are in place and considered adequate. In this context, access management is not directly addressed and may not seem necessary. This situation is typical of many western European countries. Efforts to advance the concept of access management may be seen as contrary to current goals.

Greece has recently been acquainted with the benefits of access management and the concept is currently understood. To some extent, access management concepts have been incorporated into local planning and development activities through regulations and decrees. Contemporary fears of hindering development represent the main impediment for more widespread implementation of the access management process. Continued efforts to mitigate these fears are needed to provide the necessary groundwork for further development of the concept in the future.

In Poland, the concept of access management is known and valued and perspectives on its implementation are positive. Multifunctionality of Polish roads and the intense strip

development that has occurred in the country in the last years are the most critical impediments to further application of access management. Implementation of road safety policies to reduce crashes on existing Polish roads may serve as a means to partially implement access management criteria on the existing road network of the country. The greatest potential in Poland is with new road construction, where access management policies are expected to be implemented to preserve planned levels of roadway operation and safety.

In the U.K., the concept of access management is known and practiced to some degree, but not to the extent of the United States with regard to roadway function. In urban areas, all road users and traffic modes are considered in access design criteria and public roads are considered to serve a livability and multimodal function, rather than as areas dedicated mainly for traffic movement. Experience gained in the U.K. in this regard can help with integrating complete streets concepts into access management practices in the United States. The U.K. could benefit from development of an all-inclusive access management manual to provide U.K. road designers and planners with the necessary information related to access management.

In Australia, access management for arterial roadways is of major interest and consideration has been given to ways in which influence over access to these roads can be exercised. Like the United States, a holistic and integrated approach to access management will require greater coordination between jurisdictions in light of the various planning and traffic management tools.

CONCLUSIONS

This limited international survey of access management practices has provided some information on the status of access management practices in various nations of the world. It has revealed that nations are in varying stages of developing the concept of access management for further implementation. The United States is currently working toward systemwide advancement of access management practices, with an emphasis on improved roadway network planning for all modes and careful control of access in relation to planned roadway function. South Africa and China are familiar with access management and seeking to expand their access management programs and requirements on a national level.

Many of the participants in this survey have become aware of access management through their professional practice or research activities. A broader examination of international practices will likely reveal that a majority of nations are largely unfamiliar with the concept of access management and its benefits. Nonetheless, the building blocks exist in every nation to begin integrating the concept into urban planning and regulation, as well as major roadway planning, policy, and design.

In some of the other countries, such as South Korea, Poland, and Greece, the concept has been recognized as an important factor in managing land development and is being introduced partially or occasionally, as opportunities arise. However, various reasons hinder further development of the concept in each of these countries, at least for the present. In Germany and the U.K., access management practices are limited and more strongly focused on serving vulnerable road users.

The findings of this review suggest that a strong platform for initiating the necessary policy and regulatory criteria for access management in those that lack it is the robust land use

regulation context that existed in every country reviewed. Building upon this review and the U.S. experience, next steps to be considered by the international community include the following:

1. Prioritize and advance country-specific research on the topic of access management, including both urban planning and transportation engineering considerations. This should include safety and road performance research to document the impacts of inadequate access management. Little such research has been done outside the United States.

2. Tailor the programmatic and technical approach to implementing access management to the societal and institutional context of the country.

3. Continue to test and evaluate the impacts of access management projects and actions relative to all modes of transportation and refine practices accordingly.

4. Document case studies and examples of effective practices within the country for further national and international dissemination. Share successful experiences with other nations having similar institutional and political contexts.

5. Regularly convey the results of research and practice to the professional community, government agency staff, and public policy makers through conferences, training, and other means.

6. Prepare a national access management manual to document the national state of the practice and provide a foundation for further advancements.

The transponding of a successful access management concept and the consequences of inattention to managing TRB Access Management Committee has gained an understanding of roadway access. International conferences have also been held in Greece, China, and South Africa to help facilitate increased international attention of the concept. Through its efforts, the Access Management Committee is committed to working with the international community to define a workable strategy and formulate specific activities and synergies in the upcoming years to advance the concept of access management worldwide.

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