

Access Management Policies: An Historical Perspective
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Highway safety has been a primary concern for our society since the automobile began using the nation's roadways. However, even with all the efforts on improving vehicle safety such as seat belt use, safer cars, fewer drunk drivers, and baby seats, traffic accidents remain the most likely cause of death for any reason for all people between the ages 1 and 24 years - not disease, murder or any other cause. After age 24, traffic accidents are the most likely cause of accidental death. Each day in the USA, we are experiencing over 15,000 access related accidents, including over 7,000 injuries and over 55 fatalities. This paper addresses the practice of access management, an engineering and planning technique that can achieve a 30 to 60 percent reduction in total accident frequency when applied to an arterial highway.

Access control on highways, is the management of the frequency, location, and design of driveways and street intersections. Access points, are locations for vehicle conflicts as motorists enter, maneuver and exit the roadway. The principals of access management include: limit the number of access locations, provide good separation between access locations, remove turning traffic from the travel lanes by using auxiliary lanes.

When access proliferates excessively, highways lose their intended function and capacity causing a rapid increase in accidents. Arterial roads, originally designed to connect communities, instead become congested with local traffic, leading to delays and safety problems not only for motorized traffic but also for pedestrians and other non-motorized traffic.

The loss of highway capacity comes at a high cost - both financial and aesthetic. Until recently, degradation of service has typically occurred in about thirty to forty years, but the pace of congestion is accelerating. Users experience frustratingly slower speeds, more congestion delays, more delays by additional traffic signals, inconvenience, and increased vehicle operating costs. To compensate for lost capacity and efficiency, government agencies add lanes, often consuming adjacent property. Costs of new construction and right-of-way acquisition can be substantial. When capacity deteriorates excessively, or when no room exists for additional lanes, parallel routes must be constructed, further dissecting communities and neighborhoods at even greater cost.

Access management is not a modern concept. It is simply the modern application of a concept that was first identified in the early 1900s. However, other than its limited application on the freeways, expressways, and some major urban boulevards, access management has been undervalued or virtually ignored as an engineering and safety element in roadway design and decision making.

BEGINNINGS OF ACCESS CONTROL

At the beginning of the 20th century, urban streets accommodated the horse and buggy, bicycles, mass transit (such as trolleys and electric streetcars) and the occasional automobile. Ironically, bicyclists were the most vocal proponents of improved (paved) roads. There were over 4 million bicycles and over 17 million horses. In 1900, there were only 8,000 automobiles in the entire United States. Automobiles were primarily a pleasure vehicle and not an important means of transportation due to their low horsepower and mechanical limitations. Roads that were adequate for automobiles were mainly in population centers. The electric railway systems was the number one mode of urban public transportation, reaching its peak during World War I.

Rural roads were quite undeveloped compared to roads in urban areas. They were narrow dirt surfaces built for horses and buggies traveling at 5 mph. Since the railway system was adequate and the automobile was not yet reliable for long distance travel, few rural roadways were developed for automobiles. However, some adventurous motorists were venturing into the countryside for pleasure trips.

In cities, large volumes of horses, buggies, public transit, and the occasional auto, were clogging the streets. City travel was slow and time consuming. The necessity to control the movement of all vehicles and travel modes was becoming apparent. One of the first access control state statutes was enacted by the state of New Jersey in 1902. It authorized county boards to establish "speedways" for horses and light vehicles. The legislation provided that after the location of the speedway was determined, "no public streets or other highways shall cross or intersect the speedway at grade without the consent of the county." In 1906 the U.S. Supreme Court deemed that states should determine the property rights of access by their own laws. This meant that access control along highways was within the sovereign power of the states.

The concept of access control was expanded beginning in 1914 when county officials in Westchester County, New York began establishing roadways called "parkways" in urban areas. For example, the Bronx River Parkway had adjacent buffer strips of publicly owned park land which protected the roadway from direct private access. By this time motor vehicles were becoming the major cause of travel congestion. These parkways attracted world-wide attention as they demonstrated their ability to provide convenient, safe travel with traffic volumes and speeds previously unknown in urban areas.

IMPROVING HIGHWAYS

Between 1900 and 1920, vehicle registrations grew dramatically from 8 thousand to 10 million. Automobiles were becoming more reliable, comfort was improved, and interest in automobile travel grew. Rural roads, adequate for automobile travel between towns and cities, came into

demand. However, there was no system in place to organize the old rural roads. There were no standard route markings but rather many uncrowded miles of dirt and mud. Most states were using limited private property taxes to maintain rural dirt roads. One of the first national-level, modern federal-aid road improvement efforts was funded through the U.S. Post Office in 1913 to improve rural roads for the new federal Rural Free Delivery postal system.

A 1916 federal-aid act expanded the concept of federal support for state roads, but it was still not a proposed system of longer distance interstate roads lobbied for strongly by the American Automobile Association, the American Association of State Highway Officials (AASHO) and other urban and economic interests. Federal financial support centered on the average number of mail pieces delivered per family and the number of families per mile on the federal aid route. Roadway traffic volume was a minor consideration and transcontinental auto travel had little broad public support.

At this time the railroad system remained the only effective way to travel long distances. But railroads did not serve all population centers. Trains were not scheduled to make frequent stops and were not convenient for the general population.

In 1919, the Army completed its first transcontinental military convoy by road. Departing from Washington D. C. with 260 soldiers, it took 62 days. Besides mechanical problems, they encountered mud, slippery roads, and failing bridges. The journey was so difficult that they were rewarded with medals and a parade when they arrived in San Francisco. Lt. Dwight Eisenhower participated in that cross-country fiasco. Eisenhower's experience would later influence his support for the interstate highway system.

The Federal-Aid Act of 1921 directed the establishment of a system of national route markings for selected primary rural roads and provided limited construction funding focused on helping the states close the gaps in the very irregular, piecemeal rural highway links between urbanizing areas and between states. The U.S. numbered marking system was little more than a basis for providing a national guide for touring motorists and a fledgling truck freight industry. This was a federal-aid state system, not a system of federal highways. The act still rejected the concept that the federal government should fund a national highway system.

With the growth of the number of vehicles and better roads with higher vehicle speeds came a strong rise in traffic accidents. In 1922, with very few vehicles compared to 1998, there were over 35,000 fatalities. Governor Gifford Pinchot of Pennsylvania, speaking in 1923 to a national state highway conference in Harrisburg, Pennsylvania, expressed "extreme concern" regarding the new and unacceptable level of accidents caused by automobile travel. "... in Pennsylvania the number of deaths from motor vehicle accidents per hundred thousand of population rose from five in 1915 to fourteen in 1922, which means that every man, woman and child who uses on foot or by automobile the highways of the state was three times as likely to be killed in 1922 as in 1915."

There was no control of access in rural areas except for a few suburban boulevards and some parkways in the east. By the 1930s, there were 27 million vehicles crowding the highways. The problems caused by traffic congestion and the lack of access management were becoming readily visible.

THE FIRST 'FREEWAYS'

The states were the early developers of access control concepts, both in design and in law. New Jersey in 1902, along with the Westchester County parkway projects in 1914 had clearly demonstrated the benefits of access control.

In 1937, the states of New York and Rhode Island established specific statutes that authorized state highway agencies to design and build "freeways" which included the full or partial acquisition of abutting access rights to ensure the long-term, higher performance of these highways. Many other states also adopted and implemented these statutes for use in urban and rural areas. These were not modern freeways of current interstate design, but were important rural two-lane highways or four-lane urban highways serving state interests in intercity and intra-city travel. This was the next step in the development of access control techniques, moving from using landscaped park strips to protect the expressway (1914) to using the acquisition of private property access rights by recorded deed to restrict direct access.

The Pennsylvania Turnpike, designed in 1937 and opened in 1940, was the first highway to closely resemble a modern interstate freeway with full access control. It became the model concept that the federal government used for the national interstate system.

By the late 1930s, most rural routes were still on the original alignment of the horse and buggy trails of the early 1900s with added hard surfaces. The speed, size, weight and performance of the "modern" automobile exceeded the abilities of the older alignment and strength, causing many safety, operational and maintenance problems. State highway engineers saw the necessity to establish new concepts in highway design and construction. In 1937, the AASHO Committee on Planning and Design Policies was formed. From 1938 to 1944, it produced eight policies based on best of the state practices to achieve "maximum safety and utility". These were reprinted as a collection in 1950 and became the basis of the 1954 AASHO publication, "A Policy of Geometric Design of Rural Highways", which has evolved into what is commonly referred to in the 1990s as the "Green Book".

By 1941, 51% of the families in the U.S. owned an automobile, for a total of over 34 million vehicles. The demand for better, long distance highways was ever increasing.

THE FEDERAL INTERSTATE SYSTEM

In 1941, President Roosevelt established the Interregional Highway Committee. The committee completed its report in 1944. It recommended the establishment of the National System of Interstate and Defense Highways. The report noted that the far majority of the existing network of state

highways connecting population centers (the network completed in the 1930s), was obsolete due to poor route locations, poor traffic capacity and a lack of modern highway design features. This made efficient and safe highway operation difficult. The report recommended an interregional highway system of 34,000 miles of existing highway routes for improvement to higher standards. The recommendation included the limitation of access to a practicable minimum. The report contained a suggested state model law for limited access highways. This national system had the strong support of the War and Navy Departments. The Joint Economic Committee of Congress published a report in 1950 making a strong argument for the highway needs of the states and the belief that a national system was a key to a strong national economy.

By 1944, the states had established almost 1,000 miles of access controlled highways. The states of New York, New Jersey, and Pennsylvania among others, had proven the importance of access management as a key performance factor for major highways.

Under President Eisenhower, whose memory of the 1919 convoy remained, a committee of industrial, engineering, construction and business leaders declared in 1955 that a national highway system was the "top national economic and defense priority". With regard to access control the report stated,

"One of its principal features in the provision for adequate right of way is to permit control of access to the highway itself. Otherwise, experience shows that the facility becomes prematurely obsolete due to developments crowding against the roadway which make it unfit for the purposes for which it was designed. Control of access to the degree required by traffic conditions is essential to the protection of life and property. It is also essential to preserve the capacity of the highway. So far as the investment of funds in major roads is concerned, provisions for control of access to the extent required by traffic is fundamental." A Ten Year National Highway Program, 1955.

By 1955, vehicle registrations were approaching 60 million-an addition of 30 million in the post-war boom. In 1956, aid for Interstate highways increased to 90% federal funding, 10% state funding, and interstate freeway construction went into high gear. Included was the mandatory acquisition of access rights by federal law to supplement state laws on access control that were often variable. The construction of the interstate system continued for over three decades. By 1998, the U.S. had over 45,000 miles of fully controlled freeways. But these hi-performance highways now constitute only about 1.3% of the entire public road system mileage.

During all this interest in building a new national interstate system, the larger network of other highways continued to expand also. Hard surfaced (asphalt and concrete) roads grew from a few hundred thousand miles in 1935 to over two million by 1994. The total system of public roads, including dirt and gravel, constitute the rest of the 3.9 million miles of the public highway and street systems. By 1998, total vehicle registration exceeded 200 million.

DEMAND FOR DIRECT ARTERIAL ACCESS

In the 1920s and early 1930s the concept of expanding commercial businesses along arterials was not anticipated. Strip commercial development was infrequent. Residential development was the major land use on arterials with driveways and on-street parking. Many cities allowed, and still have, a mix of commercial and residential dwellings along older principal highways, including highways on the current National Highway System. Before strip commercial development came into vogue, retail business was centered in downtown areas, or within neighborhoods and along trolley routes - all reliable sources of local pedestrian customers. Except for auto-related businesses (gas and repair services), commercial development did not rely on private auto travel. The earliest commercial businesses were in small buildings with parking limited to the street. The majority of customers were pedestrians, as still can be seen in many areas that were established before World War II.

With the growth of private automobile use, the commercial opportunities changed from business locations in neighborhoods to major arterials to take advantage of more potential customers traveling by automobile on higher volume roads. This became a competitive necessity. The age of the automobile really began to change the entire face of communities, especially at the developing edges.

With the rapid growth in auto traffic on all highways, residential dwellings on highways became undesirable. Previous residential lots were sold to commercial interests. This land-use conversion process from residential to commercial along the arterial left smaller lots for commercial use except where they were consolidated. This is one of the reasons for frequent access points and on-street parking along older arterials. As the cycle continued, the need for an automobile became more important to be able to reach the businesses which had moved to the highways, out of convenient residential walking distance.

To a large extent, traffic volume, a measure of potential customers, became the basis for business property values. The higher the volume, the higher the interest in the property, and of course direct access to the high volume road was assumed, and granted as requested. Also with the new residential suburbs of the 1940's, away from trolleys and bus lines, came the age of the auto dependent, single occupant commuter.

From 1950 to 1980, commercial properties continued to change in size, site design and impact. Vehicle registrations grew to 160 million. In the 1950s, at the fringes of urban areas, developers began developing larger lots - 150 to 300 feet of frontage, for a single use building with on-site parking. Many developers thought they should have their own piece of land for each business. By the 1960s, the pattern was changing again as business realized the advantages of shopping centers with shared parking, anchor stores, and one stop shopping. Retail parcels grew in size to 300 to 600 feet of frontage for "small" shopping centers and later even larger shopping centers were built. But driveways, seen as marketing necessities, continued to be closely spaced, often depending on where the aisles were in the parking lot. Even with the larger frontages of the 1970s,

the short driveway spacing standards of the 1940s continued to be used.

AN ACT OF OMISSION

By the late 1940s almost every state had access control statutes to some degree and several court decisions had confirmed state government's legal ability to control access rights to achieve public safety and protect the functional integrity of the highway.

While there was a strong commitment to use this access control authority for the national interstate system, the application of access control to the majority of the public roadway system as an engineering and safety element was for the most part ignored. While many miles of state level expressways, parkways and two-lane rural 'freeways' established in the late 1930s and 1940s with partial access control still existed, new non-interstate access controlled additions since the mid-1950s have been few.

The federal government recognized (and continues to do so) three levels of access control, 'full' as used for the interstate system, 'Partial' for lesser parkways and expressways, and 'no control' for all other routes. The no-control routes account for about 98% of the public highway system.

Even though access control benefits were demonstrated by many studies to be useful for all highway types, the safety and performance data coming from the access controlled expressway and freeway designed highways, was not applied to non-freeway principal arterial highways, much less to secondary highways. Management of access on non-fully controlled arterials was very weak, especially in urban areas. The new demands by expanding commercial interests for more access and frequent access to important arterials were not met with objections or apparent concern.

Most states had small decentralized permitting programs run by maintenance forces with little strength and limited to individual driveway design and construction standards. State standards for driveway spacing were commonly 10 to 50 feet - and remain so today. Auxiliary turn lanes were seldom required except at the largest volume access locations. These liberal access policies had a great price. Failure to recognize the importance of greater spacing, generally 200 to 250 feet, has proven to mean a 20% to 40% higher accident history. It was as if driveway frequency was not a roadway design element because driveways did not change the width or alignment of the roadway. It is conservatively estimated that since 1950, over one million people have died in access related traffic accidents with over 100 million injuries.

ACCESS RELATED SAFETY RESEARCH

During the road building efforts that began in the 1920s, little attention was paid to access points except for the few miles of new parkways and boulevards. Driveways and intersections were simply built where ever someone wanted one. Connections were not a roadway design consideration for engineers. Their focus was the roadway, its alignment, cross-sections, material structure and markings.

The earliest criteria developed for determining a safe access location was adequate sight distance - the ability to see far enough around curves and over hills so the driver could enter safely onto the road. Not until automobiles developed enough horsepower to exceed speeds of 30 mph was the possibility of a severe accident on a blind curve possible. Sight distance from the access became the first access location criteria for safety - and remains so today. But even as basic an element as sight distance, many driveways were and continue to be, built without this safety consideration.

As the nation expanded and became increasingly urbanized, access points became frequent. Most business access 'points' were the entire frontage of the business, allowing patrons to pull off the highway and park anywhere convenient. Only in urban areas with raised curbs (for drainage systems and aesthetics) was there some control over the wide open access.

Even as early as 1935, the piecemeal, irregular and uncontrolled sprawl of development and frequent access was seen as a problem - not just an eyesore - but as degrading road and efficiency and causing safety problems.

According to Robert Whitten, planning consultant, in 7 Harvard City Planning Studies, he states,

"The motor age is directly responsible for the blighting of the countryside. Filling stations, repair shops, lunch stands, tourist camps, summer colonies, billboards, and sporadic and sprawling urban development are playing havoc with the charm and beauty of many of our county highways.... Moreover, the present unregulated and disorderly roadside development is destructive of property values and is a serious handicap to the safe and efficient use of the highway... The enormous expenditures that are being made for highways cannot be justified unless these investments are protected by some continuing control of the uses of abutting lands." *Model laws for Planning Cities, Counties and States, Cambridge 1935, 133-134*

Since the late 1940s, the growth in traffic volumes coupled with the improved vehicle performance, higher speeds, was exacerbating the problem. The public became less tolerant of the congestion, stop and go traffic and traffic accidents on the arterial system. Complaints increased and demands for new and better roads and bypasses increased. Beginning in the 1950s, studies on the effects of frequent driveways were being conducted on county and state roads.

The safety record of access controlled routes was rapidly becoming apparent.

"The safety of controlled-access highways is excellent. The Arroyo Seco parkway compared to major streets in the same vicinity has five to eight times less [fewer] fatal and personal injury accidents. The Merritt Parkway in Connecticut has shown the amazing record of 3.5 fatalities per 100 million miles of travel. At the time of the President's Highway Safety Conference in May, the national average was 12 per 100 million vehicle miles." *MacDonald, Thos. H., Interstate or Super Highways, American Highways, April 1947.*

David Schoppert, in writing, *Prediction Traffic Accidents from Roadway elements of Rural Two-lane Highways with Gravel Shoulders*, [Highway Research Board Bulletin 158, 1957], concluded in part, "Access to the highway through driveways or intersections is directly related to accidents at all ADT levels. The number of access points is a reasonably good indicator of the number of accidents within an ADT group." It was also Schoppert's opinion that the number of accidents increases with the number of situations presenting a change in conditions and therefore requiring a decision on the part of the motor vehicle operator. This is one of the earliest conclusions that driver workload, caused in part by the frequency of access related turning movements, is a strong contributing factor in accident potential on busy highways.

Research in Oregon concluded that motor vehicle accident rates increase for several reasons including the increasing number of commercial units adjacent to the section, the increasing number of traffic signals, and the increasing number of intersections. Head, J.A., *Predicting Traffic Accidents from Roadway Elements on Urban Extensions of State Highways - 1958*, Highway Research Board Bulletin 208.

Every study since the 1940s has indicated a direct and significant link between access frequency and accidents. Roads with over 50 access points per mile were reported as having a 200% to 400% higher highway accident rate than those with only 10 to 20 per mile. There were recommendations in the reports for greater efforts to be made in driveway design and location criteria. However, this access spacing to accident relationship was largely ignored by government agencies and national associations. Access spacing standards were not revised.

National standards for individual driveway design were developed in 1960. AASHO published "An Informational Guide For Preparing Private Driveway Regulations for Major Highways". Its primary purpose was to encourage use of driveway regulations to achieve improved driveway design and operation. The guide effectively established the basics of "modern" driveway design using the best practices from several states. It provided dimensional ranges for driveway design as well as standardization of common driveway terms.

The AASHO guide also made several general policy and guideline statements regarding the importance of access controls. "Most of the interference originates in vehicle movements to and from businesses, residences or other development along the highways. Accordingly, regulations and overall control of driveway connections are necessary to provide efficient and safe operations, and to utilize the full potential of the highway investment. It is proper that some control be exercised over the number, location and general design features of driveways between the highway and adjacent private property."

The guide also expressed concern regarding property access rights. "While it is generally recognized that driveway control is necessary to maintain capacity and increase safety there is not complete agreement as to how this should be done and yet not jeopardize the rights of access to the

highway by adjoining property owners." In spite of these general principals and expressed interest in controlling driveways, and earlier access control and spacing research, the Guide has design standards that apparently supported up to 210 driveways per mile.

It recommended one driveway for short 50 foot property frontages and no more than 2 for larger frontages. It contained several illustrations showing properties with multiple driveways. The concern at the time was eliminating the wide open access that typically covered the entire frontage. Setting requirements for properly designed driveways with controlled widths of 12 to 35 feet was considered a significant improvement. Corner clearance (the distance from an intersection) for driveways was recommended at 20 to 40 feet for rural locations and 10 to 20 feet for urban locations. This guide became and remains, the basis for almost every state's driveway design and spacing standard. AASHTO has not updated this guide.

At the same time, other AASHO books were extolling the virtues of access control.

"Many of the conventional highways have become functionally obsolete in some cases solely or largely because of the lack of access control." Last year [1961] 38,000 persons lost their lives on the highway, and many thousands of others were injured. Many of these accidents occurred at intersections. This factor assumes special importance in view of that highway with full control of access were found to have an average of 2.4 fatalities per 100 million vehicle miles, whereas the fatality rates on those highways with no control of access was 5.2. In other words, the highway designed with full control of access has been found to be over twice as safe in terms of fatalities as a highway without control of access"

Chapter 10, Acquisition for Right of Way, American Association of State Highway Officials, Committee on Right of Way, Washington, D. C., 1962.

The NCHRP Report 121, *Protection of Highway Utility* 1971, has been one of the most comprehensive discussions of access control.

"The objective [of the research] has been to formulate general theory aimed at understanding the relationship between transportation and land use, and to develop practical criteria and guidelines that can be implemented to protect the enormous public investment in the transportation system from premature obsolescence or operational inefficiency."

The report delves into land use and design relationships, trip generation, highway functional classifications, access location, design and safety, arterial design controls, and multiple-Use public corridor issues. It concluded that,

"The lack of access control along arterial highways has been the largest single factor contributing to the obsolescence of highway facilities." "Inadequate access control has resulted in the functional obsolescence of an entire generation of new arterial facilities built only a short while ago."

One of the legal concerns expressed in several highway design publications is the potential impact of access control

on property rights. While access control is primarily within the purview of state laws and therefore the legal issues vary somewhat between states, it is the legal position of the majority of states that highways belong to all people, who collectively have a common and equal right to safe and unobstructed travel. While property owners do have rights of access, it is entirely appropriate to regulate the location, and design of access to the public facility, including denial of direct access to a major highway when the property retains reasonable access to a lesser street which connects to that major highway.

THE BEGINNING OF MODERN ACCESS MANAGEMENT

The first state to have a system-wide comprehensive access management program was Colorado. The state legislature declared in 1979 that all state highways were controlled access highways. This simply meant that access to the highway could only be obtained with permission from the state by a permit. The State Highway Commission was directed by the Legislature to establish the standards for such approvals and in 1981 a new state regulatory code of standards and procedures was adopted. What made Colorado's new approval process different from earlier permit systems in Colorado and other states, was the application of the principals of access management to all state routes, including principal arterials, secondaries, rural and urban - even local frontage roads - not just to freeways and expressways.

While the 1979 legislation in Colorado was generally considered progressive, one could argue the state was acting on 77 years of accumulated knowledge. The legislative concept was simple, if access control reduced accidents and improved the performance of the public highway system, therefore saving tax dollars and lives, why shouldn't such principals be applied to all public highways? The only difference between freeways, expressways and regular arterials would be the level of application, and the strength of the standards. The Colorado law has the important provision that the level of access control should be commensurate with the function of the highway and also consider other aspects, such as highway volumes and types, the character of land abutting the highway and the plans of the community. As a result, the Colorado Access Code now has eight such levels of classifications in the 1998 edition. The lower levels allow more access than the upper levels. The higher levels apply to roads with higher volumes and/or with higher speeds over longer distances. The lower categories apply to roads of lower performance and providing shorter trips. For all levels, the spacing of access (where permitted) is based on the stopping sight distance at the posted speed. While this standard is flexible, it is significantly greater than the old 1950s standards of driveway placement of 10 to 50 feet. In Colorado the desirable driveway spacing at 35 mph is 250 feet.

ACCESS MANAGEMENT - PUBLIC BENEFITS

The strongest case for the use of a system-wide access management policy, such as Colorado's program, is public safety. In the United States, traffic accidents are the leading cause of unintentional (accidental) death for all age groups. Any program that saves lives is important. In every study done in this country, access-conflict accidents related to

access movements at driveways and intersections, average over 50% of the total accident history. When access management design practices and principals are applied, reductions in accidents of 30 to 60 percent are consistently achieved depending on the condition of the road prior to the application and the level of control exercised. The implementation of access management clearly benefits the public. Access management is a cost effective bargain to improve safety and also provides mobility benefits. While the application of system standards to achieve system-wide benefits takes many years, the application of access management during a reconstruction project is immediate.

Nationally, it has been conservatively estimated (for 1996), using studies from several states, that the annual frequency of access related accidents is over 5.5 million, with 2.8 million injuries and 21,000 deaths. 900,000 of the injured were passengers and over 300,000 injuries were to those under 15 years of age. The direct annual economic loss alone exceeds \$90 billion. The fatal frequency is the equivalent of about two DC-9's crashing each week killing everyone on board. The difficulty of focusing on these numbers, is that the accidents are spread over the entire U.S., not in one or two large multi-fatal accidents as occurs when a plane crashes. The ability of applied access management principals and design standards to reduce these figures is significant.

CURRENT DEVELOPMENTS

The FHWA, working with the Transportation Research Board, is currently developing the first national access management manual. When completed in 2000, it will be a comprehensive presentation of state of the art policies, practices and standards in access management.

AASHTO is currently reviewing recommendations for incorporating modern access management techniques into the next edition of the *Green Book*, based primarily on the recent NCHRP Report 420.

Several states are reviewing their current guidelines and are considering changes in policies and standards. However, to date, only three states are known to have adopted system-wide regulation using modern standards based on the last decade of access management research and practice.

SUMMARY

The implementation of access management design principals on non-freeway arterials is in the public's best interest. Documentation of the benefits of access control has been available since 1902. Controlling the frequency, location and design of access points along a highway is a critical element in overall highway performance and public safety. Data and other information, directly linking accident rates to access frequency, has been consistently documented by many research projects for over four decades. The conclusion of the research is that keeping access to the lowest frequency possible, providing good spacing and access design when it is permitted, will achieve accident reductions of 30% to 60%. The principals and standards are readily available for any state or local jurisdiction to implement access management and begin realizing the benefits in accident reduction and improved roadway performance.

The following recent resources can provide more information on modern access management:

NCHRP Report 420, "Impacts of Access Management Techniques" Transportation Research Board, Washington, D.C. 1999 (www2.nas.edu/trbcrp)

National Highway Institute Course # 15255 "Access Management, Location and Design" which includes an excellent and recently revised (1998) class notebook. (www.nhi.fhwa.dot.gov)

Transportation Research Circular # 456, "Driveway and Street Intersection Spacing" Transportation Research Board, Washington, D.C. March 1996 (www2.nas.edu/trbcrp)

NCHRP Synthesis 233, "Land Development Regulations that Promote Access Management" Transportation Research Board, Washington, D.C. 1996 (www2.nas.edu/trbcrp)

Michigan DOT, "Improving Driveway and Access Management in Michigan", Lansing, 1996

Access Management, Lessons From Fourteen Years in Colorado, Philip B. Demosthenes, 1995

Some Elements and Issues to Consider in the Implementation of a Comprehensive Access Management Program, Philip Demosthenes, March 1993

NCHRP Report 348, "Access Management Guidelines for Activity Centers" Transportation Research Board, Washington, D.C. 1992 (www2.nas.edu/trbcrp)

Conference Proceedings, the 1st national Conference on Access Management, Vail Colorado, 1993

Conference Proceedings, the 2nd National Conference on Access Management, Vail Colorado, 1996

Conference Proceedings, the 3rd National Conference on Access Management, Fort Lauderdale, Florida 1998

Plan to attend the TRB/FHWA 4th National Conference on Access Management, hosted by the Oregon DOT, scheduled for Portland, Oregon, August 13 -16, 2000, (www.dot.state.or.us/access)

The Colorado State Highway Access Code is available at www.dot.state.co.us/business/index.htm

Other key Internet sites on access management include:
www.ctre.iastate.edu/access
www.cutr.eng.usf.edu/research/access_m.htm/intro.htm
www.odot.state.or.us/tdb/planning/access_mgt/index.html

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