A Literature Study On National Highway System

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Abstract: As one of the components of the National Highway System, Interstate Highways improve the mobility of military troops to and from airports, seaports, rail terminals, and other military bases. Interstate Highways also connect to other roads that are a part of the Strategic Highway Network, a system of roads identified as critical to the U.S. Department of Defense. The system has also been used to facilitate evacuations in the face of hurricanes and other natural disasters. An option for maximizing traffic throughput on a highway is to reverse the flow of traffic on one side of a divider so that all lanes become outbound lanes. This procedure, known as contraflow lane reversal, has been employed several times for hurricane evacuations. After public outcry regarding the inefficiency of evacuating from southern Louisiana prior to Hurricane Georges' landfall in September 1998, government officials looked towards contraflow to improve evacuation times. In Savannah, Georgia, and Charleston, South Carolina, in 1999, lanes of I-16 and I-26 were used in a contraflow configuration in anticipation of Hurricane Floyd with mixed results. In 2004 contraflow was employed ahead of Hurricane Charley in the Tampa, Florida area and on the Gulf Coast before the landfall of Hurricane Ivan; however, evacuation times there were no better than previous evacuation operations. Engineers began to apply lessons learned from the analysis of prior contraflow operations, including limiting exits, removing troopers (to keep traffic flowing instead of having drivers stop for directions), and improving the dissemination of public information. As a result, the 2005 evacuation of New Orleans, Louisiana, prior to Hurricane Katrina ran much more smoothly. A widespread urban legend states that one out of every five miles of the Interstate Highway System must be built straight and flat so as to be usable by aircraft during times of war. Contrary to popular lore, Interstate Highways are not designed to serve as airstrips. This paper presents a literature survey on National Highway system.

Keywords: Interstate Highways; Evacuation; National Highway; Widespread Urban;

I. INTRODUCTION

Numbering system: The numbering scheme for the Interstate Highway System was developed in 1957 by the American Association of State Highway and Transportation Officials (AASHTO). The association's present numbering policy dates back to August 10, 1973. Within the continental United States, primary Interstates—also called main line Interstates or two-digit Interstates—are assigned numbers less than 100. In the numbering scheme for the primary routes, east-west highways are assigned even numbers and north-south highways are assigned odd numbers. Odd route numbers increase from west to east, and even-numbered routes increase from south to north (to avoid confusion with the U.S. Highways, which increase from east to west and north to south), though there are exceptions to both principles in several locations. This numbering system usually holds true even if the local direction of the route does not match the compass directions. For example, I-94 between Chicago and Milwaukee runs primarily north-south, but bears an east-west designation to match its overall orientation, with the "east" label matching the local southward routing, and so on. In some cases the deviation can be drastic; for example, I-64 runs almost exactly the wrong way in the Hampton Roads region, where sections that once were labeled "east" running almost due west have had these labels removed due to confusion in the Norfolk, Virginia area. While in many cases, this is due to relatively short deviations, compared to the overall routing of the highway, it is not always the case. For example, I-26 is labeled east-west as its number suggests, but it carries a more generally north-south routing. Some states, such as Michigan on I-69 have chosen to violate the numbering conventions by signing the route to match it's local orientation rather than the normal convention. Numbers divisible by five are intended to be major arteries among the primary routes, carrying traffic long distances. Major north–south arterial Interstates increase in number from I-1 to I-6 between Canada and Mexico along the West Coast to I-95 between Canada and Miami along the East Coast; the exception is I-45, which does not leave the state of Texas, running from Galveston to Dallas. Major west–east arterial Interstates increase in number from I-10 between Santa Monica, California, and Jacksonville, Florida, to I-90 between Seattle, Washington, and Boston, Massachusetts, with two exceptions. There is no I-50 or I-60 (though North Carolina has proposed an I-50), as routes with those numbers...
would likely pass through states that currently have U.S. Highways with the same numbers, which is not normally allowed under highway administration guidelines.

Several two-digit numbers are shared between road segments at opposite ends of the country for various reasons. Some such highways are incomplete Interstate (such as I-69 and I-74) and some just happen to share route designations (such as I-76, I-84, I-86, and I-88). Some of these were due to a change in the numbering system as a result of a new policy adopted in 1973. Previously, lettersuffixixed numbers were used for long spurs off primary routes; for example, western I-84 was I-80N, as it went north from I-80. The new policy stated, "No new divided numbers (such as I-35W and I-35E, etc.) shall be adopted." The new policy also recommended that existing divided numbers be eliminated as quickly as possible; however, an I-35W and I-35E still exist in the Dallas–Fort Worth metroplex, and an I-35W and I-35E that run through Minneapolis and Saint Paul, Minnesota, still exist. Additionally, due to Congressional requirements, three sections of I-69 in southern Texas will be divided into I-69W, I-69E, and I-69C (for Central). AASHTO policy allows dual numbering to provide continuity between major control points. This is referred to as a concurrency or overlap. For example, I-75 and I-85 share the same roadway in Atlanta: this 7.4-mile (11.9 km) section, called the Downtown Connector, is labeled both I-75 and I-85. Concurrency between Interstate and U.S. Route numbers are also allowed in accordance with AASHTO policy, as long as the length of the concurrency is reasonable. In rare instances, two highway designations sharing the same roadway are signed as traveling in opposite directions; one such wrong-way concurrency is found between Wytheville and Fort Chiswell, Virginia, where I-81 north and I-77 south are equivalent (with that section of road traveling almost due east), as are I-81 south and I-77 north.

**Auxiliary (three-digit) Interstates (contiguous U.S.)**

Auxiliary Interstate Highways are circumferential, radial, or spur highways that principally serve urban areas. These types of Interstate Highways are given three-digit route numbers, which consist of a single digit prefixed to the two-digit number of its parent Interstate Highway. Spur routes deviate from their parent and do not return; these are given an odd first digit. Circumferential and radial loop routes return to the parent, and are given an even first digit. Due to the large number of these routes, auxiliary route numbers may be repeated in different states along the mainline. Some auxiliary highways do not follow these guidelines, however.

Examples of the auxiliary Interstate Highway numbering system

In the example above, City A has an even-numbered circumferential highway. City B has an even-numbered circumferential beltway (or loop) and an odd-numbered spur. City C has an even-numbered circumferential highway and an odd-numbered spur. Because cities A, B, and C are in the same state, each auxiliary route carries a distinct three-digit route number. Unlike primary Interstates, three-digit Interstates are signed as either west/east or north/south, depending on the general orientation of the route, without regard to the route number. For instance, I-190 in Massachusetts is labeled north-south, while I-195 in New Jersey is labeled east-west. Some looped Interstate routes use inner/outer directions instead of compass directions, when the use of compass directions would create ambiguity.

The Interstate Highway System also extends to Alaska, Hawaii, and Puerto Rico, even though they have no direct land connections to any other states or territories. However, their residents still pay federal fuel and tire taxes. The Interstates in Hawaii, all located on the most populous island of Oahu, carry the prefix HI. There are three one-digit routes in the state (H-1, H-2, and H-3) and one auxiliary route (H-201). These Interstates connect several military and naval bases together, as well as the important cities and towns spread across Oahu, and especially the metropolis of Honolulu. Both Alaska and Puerto Rico also have public highways that receive 90 percent of their funding from the Interstate Highway program. The Interstates of Alaska and Puerto Rico are numbered sequentially in order of funding without regard to the rules on odd and even numbers. They also carry the prefixes A and PR, respectively. However, these highways are signed according to their local designations, not their Interstate Highway numbers. Furthermore, these routes were neither planned according to nor constructed to the official Interstate Highway standards.

**Mile markers and exit numbers**

On one- or two-digit Interstates, the mile marker numbering almost always begins at the southern or western state line. If an Interstate originates within a state, the numbering begins from the location where the road begins in the south or west. Exceptions exist for Interstate Highways that used segments of roadway that were built prior to Interstate Highway standards being formalized and
were grandfathered into the system. Three-digit Interstates with an even first number that form a complete circumferential (circle) bypass around a city feature mile markers that are numbered in a clockwise direction, beginning just west of an Interstate that bisects the circumferential route near a south polar location. In other words, mile marker 1 on I-465, a 53-mile (85 km) route around Indianapolis, is just west of its junction with I-65 on the south side of Indianapolis (on the south leg of I-465), and mile marker 53 is just east of this same junction. An exception is I-495 in the Washington, D.C. Metropolitan Area, with mileposts increasing counterclockwise because part of that road is also part of I-95. The exit numbers of interchanges are either sequential or distance-based so that the exit number is the same as the nearest mile marker. Under the latter system, a single mile with multiple exits may be assigned letter suffixes, for example on I-890 in New York.

**Financing**

I-787 in Watervliet, New York, showing the exit 8 diamond interchange

Interstate highways and their rights of way are owned by the state in which they were built. The last federally owned portion of the Interstate System was the Woodrow Wilson Bridge on the Washington DC Capital Beltway. The new bridge was completed in 2009 and is collectively owned by Virginia and Maryland. Maintenance is generally the responsibility of the state department of transportation. However, there are some segments of Interstate owned and maintained by local authorities. About 70 percent of the construction and maintenance costs of Interstate Highways in the United States have been paid through user fees, primarily the fuel taxes collected by the federal, state, and local governments. To a much lesser extent they have been paid for by tolls collected on toll highways and bridges. The Highway Trust Fund, established by the Highway Revenue Act in 1956, prescribed a three-cent-per-gallon fuel tax, soon increased to 4.5 cents per gallon. Since 1993 the tax has remained at 18.4 cents per gallon. The rest of the costs of these highways are borne by general fund receipts, bond issues, designated property taxes, and other taxes. The federal contribution comes overwhelmingly from motor vehicle and fuel taxes (93.5 percent in 2007), and it makes up about 60 percent of the contributions by the states. However, any local government contributions are overwhelmingly from sources besides user fees. The portion of the user fees spent on highways themselves covers about 57 percent of their costs, with about one-sixth of the user fees being sent to other programs, including the mass transit systems in large cities. In the northeastern United States, some large sections of Interstate Highways that were planned or constructed before 1956 are still operated as toll roads. Others have had their construction bonds paid off and they have become toll-free, such as in Connecticut (I-95), Maryland (I-95), Virginia (I-95), and Kentucky (I-65). As American suburbs have expanded, the costs incurred in maintaining freeway infrastructure have also grown, leaving little in the way of funds for new Interstate construction. This has led to the proliferation of toll roads (turnpikes) as the new method of building limited-access highways in suburban areas. Some Interstates are privately maintained (for example, the VMS company maintains I-35 in Texas) to meet rising costs of maintenance and allow state departments of transportation to focus on serving the fastest-growing regions in their states. Parts of the Interstate System might have to be tolled in the future to meet maintenance and expansion demands, as has been done with adding toll HOV/HOT lanes in cities such as Atlanta, Dallas, and Los Angeles. Although part of the tolling is an effect of the SAFETEA-LU act, which has put an emphasis on toll roads as a means to reduce congestion, present federal law does not allow for a state to change a freeway section to a tolled section for all traffic.

**II. CONCLUSION**

A widespread urban legend states that one out of every five miles of the Interstate Highway System must be built straight and flat so as to be usable by aircraft during times of war. Contrary to popular lore, Interstate Highways are not designed to serve as airstrips. This paper has presented a literature survey on National Highway system to give awareness to some extent.

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IV. REFERENCES


