Traffic Signs

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Dollar for dollar, signs are the least costly of traffic control devices. When properly used, they can provide the lowest cost ratio of sign cost vs accident reduction. Also because of the low cost, the temptation to use traffic signs improperly often causes both an increase in accidents and a disrespect for all traffic control devices.

One might lightly dismiss the subject of traffic signs and their use by merely referring interested persons to the Manual on Uniform Traffic Control Devices, the authority recognized by all professional traffic and highway personnel in the engineering, enforcement and educational fields. However, to understand the role of traffic signs in the safe movement of traffic is to also understand the purpose of signs, what they can do, and what they cannot do. It is only thus, with adequate background knowledge, that the sincere and dedicated person can fully apply the Uniform Manual in causing traffic signs to be installed in a manner that will increase safety and reduce delay.

PURPOSE OF TRAFFIC SIGNS

The principal purposes of traffic signs are summarized in the following:

1. To inform the public of regulations about which they would not otherwise know.
2. To inform the public about driving conditions which are not readily apparent.
3. To inform the public when prima facie conditions are officially altered.
4. To provide the field conditions for routing the public in accordance with information normally found on travel maps.
5. To aid in decision-making with the prime interest being accident and delay reduction.
6. To supplement other traffic control devices.

What Traffic Signs Can Do

As can be concluded from the preceding list, traffic signs can effect the following positive or negative results:

1. Inform the public—mainly the motoring public, but also including the pedestrian and the transit or taxi passenger.
2. Misinform the public—when the information is incorrect or misunderstood.
3. Comfort the semi-informed public—by confirming or correcting information believed to be correct.
4. Disturb and confuse the semi-informed public—when the sign is in conflict with other traffic control devices or is so complicated as to not be readily understood.
5. Create distrust—when signs are incorrectly used.
6. Generate tensions—when needed and sought for information cannot be seen or is seen too late to be useful.
7. Cause accidents as well as prevent accidents, depending upon application.

What Traffic Signs Cannot Do

Traffic signs have many limitations as compared with other traffic control devices; for example:

1. Signs cannot provide a continuous guide through complicated areas and around hazardous locations in the same way as pavement markings can do under normal conditions.

2. Signs cannot be read at the same long distances as can the simpler red, amber and green traffic signal indications.
3. Signs cannot tell the complicated story of proper spacing of motor platoons down a main street which the timing of traffic signals provides without need for telling the story.
4. Signs cannot provide the various degrees of positive barriers that curbs, islands, guardrails and fences provide.

All of these limitations seem obvious, yet traffic signs are used at times with the exception that the very things they cannot do will somehow result from their use.

Traffic signs as a group of traffic control devices are the lowest in cost, but because of the simplicity of their appearance, are much abused. Sometimes they are vandalized by those who pepper them with rifle shots or plaster them with political campaign messages. Often, they are abused by civic and political leaders who misguidedly justify their action with the belief that "even if a traffic sign at a particular location does not do good, such an innocent installation can do no harm"—and it satisfies a constituent for a very low cost!

REGULATORY, WARNING AND GUIDE SIGNS

The following material illustrates from actual experience successful and unsuccessful traffic sign installations on urban and suburban streets. Signs used only with signal operation, one-way operation, reversible-lane operation, curb-parking restrictions and transit operations, are reviewed as to the application of the regulations by others in the Conference and therefore will not be covered in this paper.

Traffic signs are classed in three categories: regulatory, warning and guide. Only a few examples of installations in each category can be cited, but the examples emphasize the need to know the when, where and why of traffic signs.

Stop Signs

STOP signs generally lead all other traffic signs in number requested by the general public. In the City of San Francisco with a population of 750,000 and less than 7000 intersections, requests for STOP signs were received from the general public in 1966 for 110 intersections, of which 25 requests were for additional signs at locations already controlled. Only 20 of the 110 requests were found to warrant installation.

In addition, 27 other intersections where signs were not requested by the general public were found by routine study and investigation to warrant STOP sign installations. Two more installations were ordered by the city fathers over the negative recommendation of engineers and police.

These statistics show that a major problem in connection with the installation of STOP signs is knowing when to say "no."

The following three brief examples of STOP sign installations describe where increased accidents or congestion was experienced.

Example 1. A major city, residential area, secondary feeder street, 3200 ADT with a minor cross street. City council ordered signs stopping the secondary feeder street.

> Results: (3-yr periods) accidents down from 12 (of which 6 occurred in one year) to 6 in after period.

But at the next intersection along the feeder street accidents increased; for the same periods:

> Results: accidents increased from 10 to 31.
> Overall Change: 225 percent increase and STOP signs were then required and installed at second intersection.

Example 2. Same city, another residential area, minor feeder streets "A" and "B" crossing a minor local street. City council ordered signs stopping feeder street "A."

Results: (3-yr period) accidents down from 8 to 3.

But at feeder street "B" accidents increased and for the same period:

Results: accidents increased from 4 to 24 (calculated 3-yr rate).
Overall Change: 225 percent increase and STOP signs were installed at feeder street "B" within 18 months.

Studies established that STOP signs at first intersection caused traffic to reroute itself through the second intersection; thus causing the increase in accidents.

Example 3. Complaint made by city council of small town to county traffic engineer that the newly installed traffic signal on the county road and main street of the town was creating congestion. Investigation showed that installation of STOP signs ordered by the city council on the main street within 250 feet of new signals was the cause of the congestion. Signs were removed and congestion disappeared.

STOP signs installed under the warrants of the Uniform Manual will in nearly all cases reduce both accidents and congestion. Favorable installations are so very numerous and well known throughout the nation and in each governmental jurisdiction that they have not been included in this paper.

Yield Signs

YIELD signs, as a regulation, are at the same time both more and less restrictive than STOP signs. They are more restrictive in that they should be used only where there is adequate sight distance and less restrictive because traffic is not required to stop except for cause.

A study of the effectiveness of YIELD signs in San Francisco installed between 1952 and 1965 showed that of 23 installations, 12 produced a significant improvement, 9 showed no significant change and 2 installations significantly increased accidents. Significance for this purpose is defined as a change of an average of one or more accidents per year susceptible to correction by YIELD signs.

Eliminating 3 of the 12 intersections showing an improvement, because of unusual conditions, the 9 remaining intersections produced an average improvement by a reduction from 4.5 to 3.0 accidents per year. Those showing no significant difference varied from 1.9 before to 1.3 accidents per year after. The average periods represented were 4 to 5 years before and 6 years after.

No Left Turn Signs

While to the public STOP signs are best recognized as a traffic control device for reducing accidents, to the traffic official NO LEFT TURN signs are probably considered the more useful all-round control device among traffic signs in reducing both accidents and congestion.

Example 1. At Broadway and Columbus Avenue in San Francisco, right in the heart of the night club area and the crossroads of two major routes into and out of the business and financial section of downtown San Francisco, excessive congestion and accident experience existed with a total intersection volume of 36,000 vehicles daily. The two streets crossed at a flat angle with significant left turns in all four directions but with the two "easy" or flat left turn movements having very heavy volumes.

Studies by the traffic engineer caused him to recommend the prohibition of all left turns. Upon consideration of the necessary legislation by the city council, it was returned to the traffic engineer for reconsideration of changing the then existing two-phase signal operation to three-phase operation which would provide for the major left turns. Because the normal four lanes in all directions and five lanes during peak hours were operating at near capacity, no change was made in signal operation and a 90-day trial of NO LEFT TURN signs was ordered. It was successful and is still in operation.

Results: accidents per year down from 23 to 11, or a reduction of 52 percent.

Capacity was increased an average of 19 percent on all legs (minimum increase was 10 percent).

Travel time improved a minimum of 11 percent for the prohibited left turners using their new route and between 35 and 100 percent improvement was experienced by other traffic.

Many other outstanding examples of the value of the use of NO LEFT TURN signs can be found.

Example 2. A state highway route past a state college in a residential area carrying 32,000 vehicles before and 34,000 vehicles daily in the after study.

Results: total accidents for 1½-yr periods down from 23 to 13, a reduction of 47 percent. Left-turn accidents were down from 12 to 2.

Same state highway route but two different intersections one mile apart, same 1-yr period, same characteristics and percent cross traffic: Location 1—51,000 ADT, left turns allowed; and Location 2—54,000 ADT, left turns prohibited.

Results: (1-yr periods) less accidents at Location 2, down from 41 to 15 (left-turn accidents down from 19 to 1).

Overall Change: 66 percent better with NO LEFT TURN signs.

Incidentally, Location 1 (cited for 1959) is still without major improvement and 8 years later, has 59,000 ADT with accidents continuing at 44 to 59 per year. The political strength of a neighborhood shopping area 6 blocks away has been the cause of failure to improve this bad condition.

The placement of traffic signs, particularly regulatory signs, is of extreme importance.

Example 3. At a downtown intersection of a large city, 42,000 veh/day, extreme congestion was readily apparent as being caused by left turns. Large (3 by 4 ft) NO LEFT TURN signs were installed on the near right and far left corners for both directions on one street (the other two left turns already were prohibited at the peak periods).

Results: (1-yr periods) accidents up from 16 to 32 (calculated rate).

Three months after the original sign installation, two small center islands were installed containing standard size NO LEFT TURN signs. One year after signs were installed on the center islands:

Results: (1-yr periods) accidents down from 32 (calculated rate) to 18.

Overall Change: congestion reduced to normal; volume up 10 percent.

Example 4. Extreme tenacity is also occasionally required to make regulatory signs work. NO LEFT TURN signs were installed at an intersection of two major streets in a major community business area, with 33,000 veh/day.

Results: (1-yr periods) accidents down from 31 to 12.

Overall Change: reduction 38 percent.

But the police and traffic engineers almost removed the signs because concentrated enforcement of a "duck pond"[1] for about a year was required to change the left-turn habit of the motorists. To wit, one motorist having been tagged by a motorcycle officer standing in plain sight, not only repeated his violation within a half hour, but also repeated it twice the next day—all with the same policeman on duty.

[1]Duck pond: a location where violations are so frequent enforcement officers are not limited in the number of tickets they can write.

Perhaps the worst thing that can be done is to install an unwarranted regulatory sign. At the request of transit authorities, a city council ordered the installation of peak-hour NO LEFT TURN signs on a major bus route crossing a state highway within the civic center area, with the city hall on one corner. Studies did not support that accidents or congestion warranted the installation. The ADT at this intersection was 52,000.

Both concentrated and sporadic police enforcement proved the location to be a duck pond of violations over a 5-yr period and despite two 3 by 4-ft signs, traffic judges regularly dismissed tags because it was claimed that the signs were not visible. The regulation has now been removed without evidence of adverse operating conditions for transit or the public.

Speed Zone Signs

Speed zone signing is a traffic control device that is not greatly used but, when warranted, is very effective in reducing maximum speeds and increasing minimum speeds. It is a safety device because, by reducing the range of speeds, more motorists drive at more nearly the same speed; thus reducing one cause of accidents—speed differentials.

A second important use of the speed zone signs is to change legally a prima facie speed either up or down when the prima facie speed does not apply to safe operating conditions. This also is used as a safety device which causes a reduction in the range of speeds existing under prima facie conditions.

Example. On a 2-lane highway through a small town with about 8000 ADT, maximum speeds were found to be 80 mph on a prima facie 65 mph roadway. The average critical speed (85 percentile) in the before study was 57.5 and 54.1 at two locations one-half mile apart. After 55 mph speed zone signs were installed, the maximum speed was found to be 70.6 mph and the average critical speeds at the two locations were 51.9 and 55.0, respectively—a reduction of 10 mph in the maximum speed.

A third effective purpose of speed zone signs is to provide a systematic method of gradual speed reduction and speed increase when the prima facie conditions change too quickly for realistic response by all motorists. Again, the primary purpose of speed zoning is to provide practical legal speeds which will encourage all motorists to more nearly approach the same driving speed and thus reduce the range between maximum and minimum speeds.

Warning Signs

The warning sign category includes signs for various crossroads, obstructions, curves of differing degrees of curvature and safe operating speeds and many other conditions about which the motorist must be warned.

The need for such signs is generally quite apparent either from driving the road or from investigation of an accident. The most likely problem to occur in connection with the installation of warning traffic signs is their placement and the use of the companion advisory speed sign when required.

Signs must, of course, be visible. Such a statement seems unnecessary, yet one major city had posted large 2-way arrow signs at the far side of a T-intersection that occurred at the top of a very steep hill. After a bad fatality at one intersection, it was discovered that accidents of a similar nature had taken place at other T-intersections but never in sufficient numbers to indicate the need for special study. The study immediately revealed the need for advance T-Symbol signs. A later check showed a drop in accidents at intersections where treated.

A 35 mph curve at the end of a long tangent serving 40,000 vehicles on a one-way 2-lane road had a high accident experience. A standard curve sign with an advisory speed sign was installed in advance of the curve which was lighted and generally visible to motorists.

Poor vertical and horizontal alignment could not be corrected by the use of signs, but oversized advisory speed signs instead of oversized curve signs and the relocation of the signs a greater distance in advance of the curve emphasized the need for a speed reduction. The change provided more time for the motorist to adjust his speed.

Shape, Color, Reflectivity and Maintenance

Before leaving the subject of regulatory and warning signs, attention must be called to the importance of those sign conditions which experienced traffic engineers and sign personnel accept as routine knowledge. Any one of the subjects—standard shapes and colors, reflectivity for all signs intended for use by the motorist at night, and a high level of maintenance—could in itself warrant a complete paper because of its importance.

One must be content, however, at this time to state flatly that there is a mountain of research and experience available to back up the need for standard shapes and colors, reflectivity and regular high-quality maintenance as specified in the Manual on Uniform Traffic Control Devices available through the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

Guide Signs

Normally thought of as directional signs which guide motorists over specific routes and through urban areas, the category of guide signs leading to specific locations of recreation, business and trip generating centers requires as much attention as STOP signs in order to prevent their overuse. In fact, the number of requests in large urban areas is so great that there is need for a strong policy limiting their use in order to keep directional signs from interfering and competing with regulatory and warning signs.

One large metropolitan area will not install a directional sign for a specific center if the location or center can readily be found by use of a city map available at any gas station. They confine their directional signing to general areas such as BEACH, or CIVIC CENTER, and only install signs on the major roads in the vicinity.

Specific locations justify directional signs only when such signs will relieve a problem of congestion or an existing hardship for the motorist.

Street Name Signs

Perhaps the sign most often installed by the traffic engineer and yet generally not thought of as a traffic sign is the street name sign. Street name signs, in the guide sign category, have been used in urban areas since long before the coming of the automobile, and unfortunately, in some localities the same street name signs are still being used.

The faster speeds of the automobile, the greater traffic volumes confronting the driver, and mechanical horsepower which cannot be trained as the horse could, has given the street name sign a far different role from that which it had many years ago. In fact, its role is so changed that it is surprising that so many urban streets and suburban roads have been neglected by lack of upgrading such signs.

There are many different techniques for dressing up the street name sign in a fashion so that it can play its part in modern transportation: larger letters; inclusion of block numbers; same general location for all installations; unobstructed view, location in the same vicinity as traffic signals or other major regulatory signs, double or triple signing at wide or busy locations, and location in advance of intersections when practical for high-speed roads.

A street name sign still has the same simple objective it had in the years before the automobile—to be seen in time to make a safe decision. The only difference is that it must be seen sooner to compensate for high-travel speed and competition for the motorists' attention. Of course, the necessity of being seen in time to make a safe decision applies to all traffic signs whether regulatory, warning or guide.

There is one important difference between the street name signs and all other traffic signs. It is seldom, if ever, that a community has too many street name signs. All other traffic signs have a time and place where they do good and a time and place where they can do harm and should not be used.

CONCLUSIONS

Traffic signs to be successful must first be uniform everywhere the driver goes. The Manual on Uniform Traffic Control Devices is an authoritative document that provides such uniformity. Second, traffic signs must be properly used because they can cause accidents as well as reduce accidents. Persons responsible for the installation of traffic signs should recognize the need to know when, where and why traffic signs should be used.

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Addenda

Use of Yield Signs

Experience in YIELD sign use reported from Skokie, Ill., showed that extensive violations of the signs at three locations led to installation of experimental supplementary "information" sign installations. These signs read, "This Means Slow Down and Stop

for Cross Traffic." While the widespread use of such non-standard signs is in no way recommended, the results of this experiment showed:

Before:
Exposure Years, 11.3
Accidents (right-angle type only), 10
Frequency per year, 0.89

After:
Exposure Years, 5.9
Accidents (right angle), 2
Frequency per year, 0.34

At three other locations in the same city, traffic volumes and intersection sight distance restrictions indicated replacement of YIELD signs with STOP control. Results were as follows:

Before (with two-way YIELD)
Exposure Years, 14.5
Accidents (right angle), 16
Frequency per year, 1.10

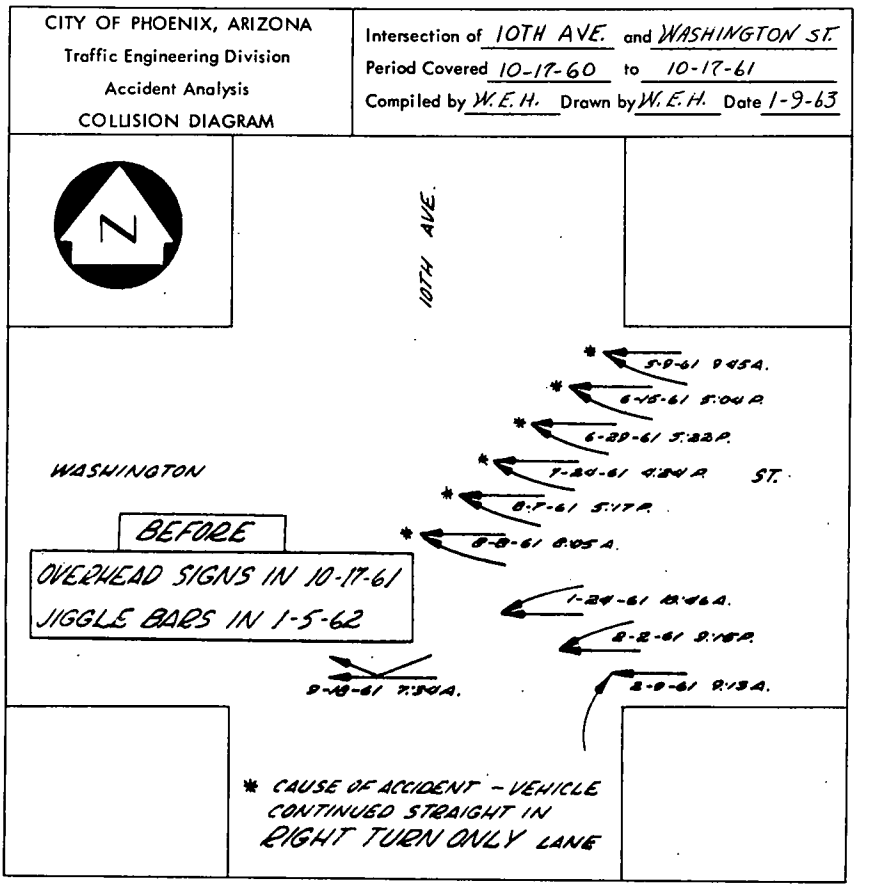

Figure 1.

After (with two-way STOP)
Exposure Years, 3.9
Accidents (right angle), 1
Frequency per year, 0.26

Phoenix, Ariz., Overhead Signs and Jiggle Bars

Washington Street is a major one-way street through downtown Phoenix, Ariz. For some years the major route turned 90 degrees at 10th Avenue. A serious accident problem was identified through the use of accident records. Two hundred lineal feet of jiggle bars and overhead signs were installed at a cost of $520. The before and after collision diagrams (Figs. 1 and 2) show the results. The average daily traffic at this point was approximately 10,800.

Toronto, Ont., Reversal of Stop Signs

Table 1 gives the findings of a Toronto metropolitan area study, relating to accident changes produced by reversal of STOP signs. These were in residential areas, where the signs generally faced the wrong (heavier volume) flow of traffic.

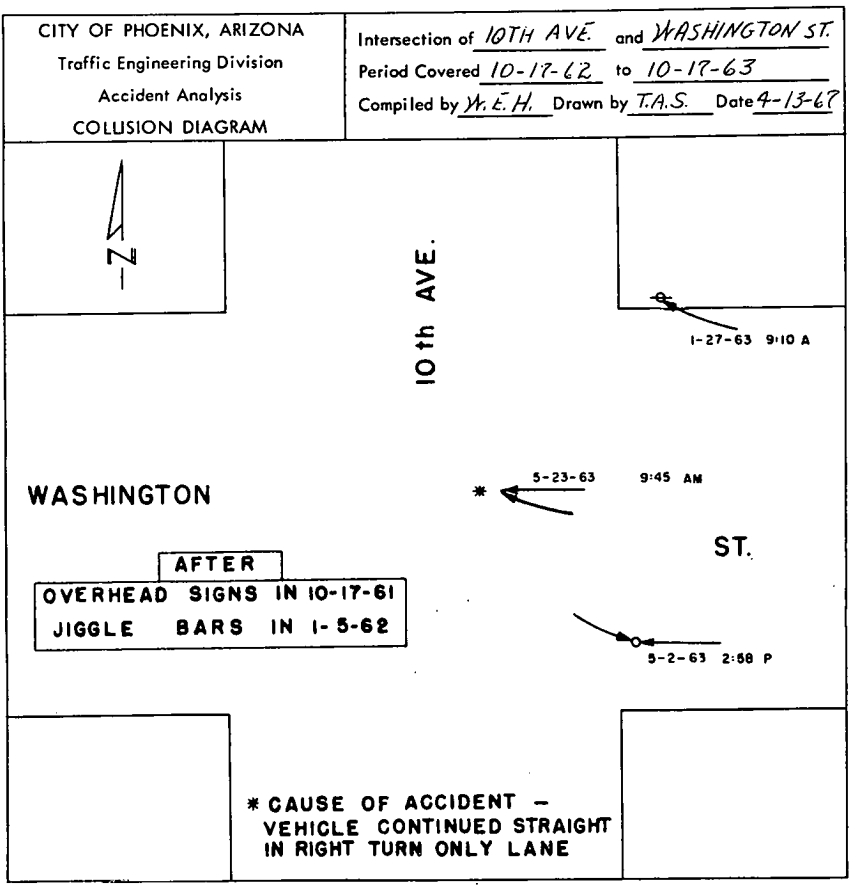

Figure 2.

TABLE 1

REVERSAL OF STOP SIGNS

Intersection	Date Right-of-Way Changed	Accidents per Year	
		Before	After
Alfred and Dudley	Sept. 1964	1	0
Ameer and Regina	Feb. 1965	2	0
Ameer and Baycrest	Feb. 1965	1	0
Byng and Dudley	Sept. 1964	3	1
Doris and Elmwood	Aug. 1965	1	1
Doris and Empress	Sept. 1963	1	1
Doris and Spring Garden	Aug. 1965	1	1
Dudley and Empress	Sept. 1963	2	1
Dudley and Parkview	Nov. 1965	3	1
Empress and Highgate	Sept. 1963	0	0
Empress and Longmore	Sept. 1963	2	0
Hillcrest and Kenneth	March 1964	0	0
Kenneth and Olive	March 1964	2	3
Khedive and Regina	Jan. 1965	1	2
Total		20	11

New Haven, Conn., Removal of Unwarranted Signs

In 1957, two years after the New Haven department was established, a complete inventory of all signs throughout the city was undertaken. (Sign installation has previously been under the police department.) In one middle-class residential neighborhood alone, comprising approximately 15 miles of local streets, by actual count 275 assorted pedestrian signs ("Slow—Children Playing," "Children in Street," etc.) were recorded. There was one grade school in the neighborhood. All streets were constructed to relatively good local street design standards.

Work orders were issued for the removal of all unwarranted and non-standard signs (275)—proper school warning signs were erected for the school at its primary, secondary and tertiary crossing points (some 10 locations), in accord with a planned school safety program. Residential reaction was initially noisy, but full explanations were given in each case and the sign program, as adjusted, remained in effect. Continual review of pedestrian safety provisions in the period 1957 to 1966, in this neighborhood, revealed no pedestrian problem which the former type of signs or placement pattern might have improved. This firm policy of providing pedestrian warning signs only where warranted, has engendered a high level of motorist observance to warning signs.

District of Columbia, Color Coding Route Markers

The color coding of route markers in the District of Columbia was an experimental project carried on in cooperation with the Bureau of Public Roads. This project involved using blue, red, yellow and green US route marker signs for the four cardinal directions. In other words, any US route that proceeded through the District in a northerly direction had all blue signs regardless of whether it was designated as US 1, 29, 50 or 240.

This plan was also believed to have been tried in Arizona. In fact the Arizona State Highway Department Map carried a detailed explanation of this system. Unfortunately, the general public was not fully aware of the trial system used in the District of Columbia. In addition, it is somewhat difficult to educate all the motorists in this area since there are so many millions of visitors to the Nation's Capital each year. After about a year of using the quad-color US route sign-marking system the project was abandoned.

The use of these signs preceded the final decision regarding the use of red, white and blue Interstate markers. Washington's experience just did not justify the continuation of the color-coded system although there still seems to be some sentiment among traffic engineers regarding its use.