TECHNICAL MEMORANDUM

# DIAGNOSTIC STUDIES OF HIGHWAY VISUAL COMMUNICATION SYSTEMS

HPR-2(108)

PILOT SITE NUMBER 5

MARYLAND STATE HIGHWAY 26 (LIBERTY ROAD) BALTIMORE, MARYLAND

TM2(108)-5

## INTRODUCTION

The "Diagnostic Studies of Highway Visual Communication Systems" research project has been designed to: (1) review the current practices in visual communications with the automobile driver using a multi-discipline team approach; (2) identify the deficiencies in these practices; and (3) recommend changes in the existing standards. Pilot studies were conducted in three states (Arkansas, California, and Maryland) in order to develop the diagnostic study techniques and to acquaint the members of the Project Policy Committee with these procedures. This memorandum is a detailed report on the results of the diagnostic team review of sites within these states. The opinions expressed are those of the diagnostic team and not the recommendations of the research staff. The results of pilot studies and the improvements recommended by the staff will be combined as an interim report to be published in the near future.

## DESCRIPTION OF STUDY PROCEDURES

The diagnostic evaluation of the study site was conducted using both the driver interview and the open-end questionnaire techniques. Each member is asked to drive a route following the instructions of the interviewer. The route included short sections on adjacent facilities as illustrated in Figure 1. The driver was asked to comment on the roadway section as he drove, and these comments were recorded. The interviewer asked questions only as necessary to keep the conversation productive. At the conclusion of each driving phase (night and day), the subject was asked to complete a questionnaire. The interviews and the comments on the questionnaire are the basis of the material presented in this memorandum.

## STUDY SITE CHARACTERISTICS

Pilot Site No. 5 is located on Maryland State Highway 26 and extends from the west city limit of Baltimore, along MD 26 west to the intersection on MD 26 and Washington Avenue. This section of roadway is urban in nature with several signalized intersections. The study section is approximately two miles in length.

Liberty Road (MD 26) has a 60-foot roadbed section comprised of four 11-foot travel lanes and a 16-foot painted median. Left-turn storage lanes have been provided on Liberty Road at intersections with other major roadways. The median area along Liberty Road can be used for left-turn storage, although the median area does not have pavement markings indicating this left-turn storage area.

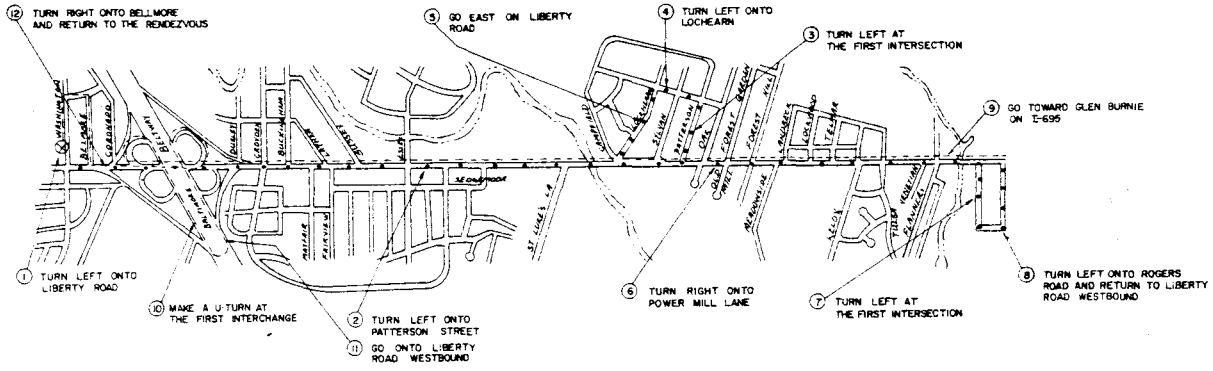
The section of Liberty Road that was studied as Pilot Site No. 5 is a curbed roadway with a bituminous concrete surface. At the west end of the study site, Liberty Road interchanges with I-695, Baltimore Beltway. Pilot Site No. 5 passes through gently rolling terrain and has a few concrete retaining walls in some of the cut sections. The section of Liberty Road studied had one-side fixed illumination.

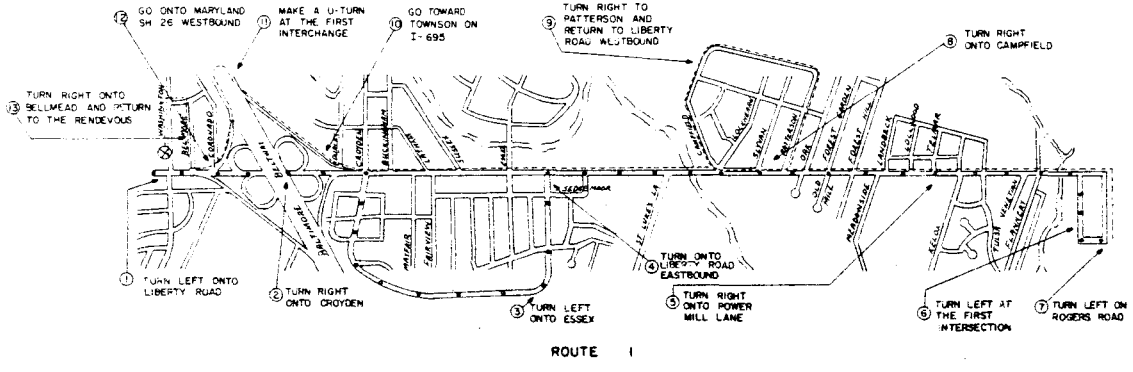
Directional signing at the I-695 interchange is overhead. Parking is prohibited during the peak traffic periods.

The section of Liberty Road studied as Pilot No. 5 had an average daily traffic of 20,800 vehicles in 1963, and has a projected A.D.T. of 36,000 vehicles in 1980. Liberty Road has been zoned for a speed recorded in October, 1968 of approximately 41 mph, with a mean speed of approximately 36 mph.

The 1967 accident record shows 110 accidents of which 48 resulted in personal injury. There was one fatality in 1967. The majority of the accidents occurred during the daylight hours on dry pavement and involved a rear-end collision. The apparent accident rate is 6.03 accidents per million vehicle miles of travel. This compares with an expected rate of 6.09 indicating no particular safety problem.

A strip map of the study section is presented in Figure 1.

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PILOT SITE NO. 5
STATE HIGHWAY 26
(LIBERTY ROAD)
BALTIMORE, MARYLAND

STRIP MAP OF STUDY SITE 5 INDICATING DRIVING ROUTES
FIGURE 1

# DIAGNOSTIC TEAM REVIEW

## PILOT SITE NO. 5 MD26, BALTIMORE, MARYLAND

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### General

The team review of Pilot Site No. 5 indicated a lack of adequate street name signing. The signs were too small in size and legend to be recognized at the legal speed limit. Most team members felt that larger street name signs were needed, and that advance street name signing should be used on approaches to major intersections. Since the routes driven by team members covered a portion of I-695, several comments were made concerning I-695 signing and delineation. A majority of the diagnostic team was of the opinion that diagrammatic signing should be used on approaches to the interchanges on I-695. This type of signing would relay the interchange layout to a driver.

### Suggested Design Improvement

Most of the improvements recommended for the study section were concerned with traffic operations. The possibility of increasing the lane width from eleven to twelve feet was discussed by the team.

The use of a mountable curb-type median was also discussed. It was the general opinion of the team that pavement markings would suffice, provided they are properly designed and maintained.

The use of high curbs on the I-695 interchange ramps was of some concern to the team. It was felt that a lower type curb design should be used.

### Suggested Operational Improvements

Signing - The most prevalent problem area along Liberty Road according to the diagnostic team, was the size of the street name signs. While traveling at the legal speed limit, diagnostic team drivers and observers were not able to follow the designated route because of an inability to read the street name sign far enough in advance to make a proper turning maneuver Diagnostic team members expressed a desire to see larger street name signs placed for major intersections along Liberty Road. One team member felt that for every intersection that has left-turn storage, advance street name signing should be provided. Basing the size of the street name sign on the legal speed limit was discussed by the diagnostic team; however, one team member felt that a realistic design speed should be selected, and the size of the street name sign should be based on this speed. The variation in street name signing along Liberty Road points out the fact that coordination between governmental agencies is needed in uniformity of composition and location of street name signing.

The diagnostic team was of the opinion that diagrammatic signing for interchanges on freeways should be used to display to the driver the layout of the interchange. Also, the diagnostic team felt that an interchange numbering system, such as the one used on I-695, is most beneficial in helping a driver locate the interchange at which he desires to exit.

The problem of having to place numerous signs, such as "NO PARKING" signs, to enforce ordinances was discussed, but the diagnostic team was informed that the number of signs that have to be used are dependent on traffic court decisions.

Delineation - In a discussion on the median area along Liberty Road, several members of the diagnostic team felt that a more positive type delineation should be used for the median area and left-turn storage lanes. Left-turn arrows and pavement markings and a mountable-type median were suggested as a means of accomplishing positive delineation. If the median area is to be used for left-turn storage, several members of the diagnostic team felt that it should be marked for left-turns. One team member felt that the marking of curb radii with reflective paint would be most helpful to the driver.

Illumination & Signalization - Several members of the diagnostic team said that they experienced an objectionable amount of glare from advertising signs at several locations along Liberty Road.

The diagnostic team felt that some of the traffic signal heads along Liberty Road have been placed over the wrong traffic lane. Several team members were of the opinion that left-turn arrows on the traffic signal head should be used where the turning movement is protected by a leading or lagging through green indication.

## General Summary

The most notable feature of this study section was the absence of adequate street name signing. This breakdown in driver communication is most critical, as it can produce operational problems.

The provision of left-turn storage areas at major intersections improves traffic operation, but the intersecting street must be recognized to provide the best use of left-turn storage areas. This problem can be helped by use of advance street name signs for major intersections.

The use of a wide median area for two-way turns is also beneficial, but the left-turn area should be so marked to eliminate driver confusion.

LIST OF APPENDICES

APPENDIX "A"

## DESCRIPTION OF THE STUDY PROCEDURES

The diagnostic evaluation of a study is conducted in four separate phases:

a. Preliminary session
b. Day driving phase
c. Night driving phase
d. Diagnostic team review

The preliminary session is designed to introduce the interdiscipline team to the objectives of the study and to explain the study procedures. The diagnostic questionnaire is presented to the team and discussed with them. The explanation of the questionnaire concentrates on the fact that it is not designed to obtain a particular response from them, but rather it is designed to direct their thinking into a particular area and thus elicit comments which the individual might care to make.

The day phase of the on-site review begins on the afternoon of the first day of the study. The diagnostic team members are transported to the rendezvous point at one end of the study section. Two cars are used in the driver interviews and, upon arrival at the study site, the number one drivers begin their driving runs with the other team members remaining in a car stationed at the rendezvous point. The driver is given instructions well in advance of the required maneuver, and his comments regarding the communication systems provided are recorded on a portable tape recorder. The comments are tied to the roadway through reference markers located at the roadside. The marker numbers are read and recorded on tape as each is passed. After completion of the driving run, the team member moves to an observer position, and the second driver begins his driving run. A different route is driven by the second driver. Errors made during the driving phase are corrected as soon as it is practical to do so. When both the driver and the observer runs are completed, the team member is asked to complete the diagnostic questionnaire on the daylight phase. The process is repeated until all team members have served as a driver and as an observer.

The night phase is conducted in the same manner as the day phase and is held on the evening of the first day of the study.

The morning of the second day of the study is devoted to a team review of the study site. Problem areas are identified, and suggestions regarding possible solutions are discussed. The team is not asked for a consensus of opinion on the improvements which should be made on the study site. Rather, all ideas are explored regardless of how many or how few of the team members might support them.

The comments made on the diagnostic questionnaire and the summaries of the driver interviews are the basis of the Technical Memorandum on the study site, which is the formal report of the opinions expressed by the team.

APPENDIX "B"

SUMMARY OF DIAGNOSTIC QUESTIONNAIRE

PILOT STUDY SITE NO. 5 MD 26 BALTIMORE, MARYLAND

Question: Did you, as a driver, lose visual contact with the roadway at a distance less than your desired distance at any point along the vehicle's projected travel-path?

| Answer: Yes | No | Restriction & Location |
|---|---|---|
| | x | Roadway vertical alignment. Location - west and east bound at Rodgers Avenue intersection |
| x | | with Liberty Road. |
| x | | Roadway vertical alignment; Location - Rodgers Avenue. |
| | x | |
| x | | Roadside development. Location - several of the residential street intersections on both routes. Shrubs and trees that are located at street intersections are a definite hazard, as they block the driver's view. |
| x | | Roadway vertical alignment. Partial loss of vision due to not only vertical alignment, but by visual searching for destination signs (street signs). |
| | x | |
| x | | Street crossing, Essex Road, Liberty Road. Other street intersections outside Liberty Road. Interstate northbound north of Liberty Road had deficient sight distance due to horizontal curve. |

Question: How would you evaluate the importance of the view of the road, or lack of it, in the driving task?

/ / Of little importance

/ / Of some importance

/ / Relatively important

/ / Critical problem

Answers on next page.

| Answer: | OLI | OSI | RI | CP | Comments |
|---|---|---|---|---|---|
| | | | | x | To have the view of the road is equally important to the driver, as having an adequate stopping sight distance available at high speeds. |
| | | | x | x | In the case of city streets and low speed - "Of some importance." In freeway and high speed - "Critical problem." |
| | | | | x | One must see to stop or turn. |
| | | | x | | The destinations were poor - speed had to be reduced, and left turn destinations were impossible on Liberty Road. |
| | | | | x | Sight distance at intersections should be such as to permit view of approaching traffic so as to be able to merge in traffic safely. |
| | | | x | | The view of the road tends to lose a driver insofar as driver tension is concerned, thereby eliminating accident confusion or potential. |
| | | | x | | In the absence of adequate warning signs or devices, the view becomes paramount. |
| | | | x | | Side streets and private entrances would have developed problems without adequate view; striping - visibility poor. |

Question: Do you, as a driver (observer), feel that the points of divergency from the traffic stream are obvious in time for the normally alert driver to make a smooth, natural transition to the diverging roadway?

| Answer: | Yes | No | Comments |
|---|---|---|---|
| | | x | Due to the lack of advance signing and obscured view at the intersection. |
| | | x | On the city street intersections, the points of divergency were not well marked in many cases. |
| | x | | |
| | | x | Signs too small. |
| | | x | Street name signs too small to see at a distance that will make it safe to turn off from a 40 mph traffic lane. |
| | | x | The street pattern tends to complicate the divergency points (except on the freeways). |

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| Yes | No | Comments |
|---|---|---|
| x | | Again this leans rather heavily on traffic devices per se. |
| | x | Left turn bays ineffective due to small street signs; often to driver's left. |
| | | Advance warnings for ramps too close to diverging point. |

Question: Does obscured visibility along the roadway create any noticeable degree of erratic behavior on the part of the driver?

| Answer: Yes | No | Comments |
|---|---|---|
| x | | The left turn lane taken in the anticipation of the proper exit and found to be wrong. |
| x | | Reduce speed and causes erratic movements. |
| x | | With respect to street signs being blocked from view. |
| x | | Considerable comment on tape - especially regarding street signs and blind intersections. |
| x | | The pole line definitely affected the visibility of the driver looking for street signs. The varied number of unnecessary signs (in my opinion) also tend to affect his behavior. |
| x | | |
| x | | Buses, trucks, etc., obscured small street signs which driver had searched for from right (curb) lane. Signs often to driver's left. |

Question: Does the driver appear to have difficulty in maintaining the vehicle within the lane (i.e., does he tend to encroach on adjacent lanes)?

| Answer: Yes | Not to any marked degree | Comments |
|---|---|---|
| | x | |
| | x | |
| | x | |
| | x | |

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(continued)

| Answer: | Yes | Not to any marked degree | Comments |
|---|---|---|---|
| | | x | |
| | x | | The high curb has a tunneling effect, often keeping one to the left of center of his lane - until one gets used to it. |
| | | x | |
| | x | | Examples: When he does not know which left turn bay to enter into designated street; high vertical curbs. |

Question: Is the normal traveled-way clearly delineated from parking and emergency stopping areas?

| Answer: | Yes | No | Comments |
|---|---|---|---|
| | x | | |
| | | | In the newly completed section of S.H. 26, it was marked; however, in the older section the delineation was very poor. |
| | | x | i.e., where parking is allowed during certain hours. |
| | | x | |
| | | x | |
| | x | | |
| | | x | Most of the study project has "NO PARKING" signs. However, vehicles stopped in curb lane and caused traffic congestion, blocking of vision, etc. |

Question: Does there appear to be any substantial amount of vehicle encroachment on the parking areas?

| Answer: | Yes | No | Comments |
|---|---|---|---|
| | | x | |
| | | x | |
| | x | | Where parking is intermittent. |
| | | x | |

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(continued)

| Yes | No | Comments |
|---|---|---|
| | x | Not observed in our runs. |
| | x | |
| x | | Particularly on side streets; also see previous question. |

Question: Are the roadside hazards (bridge abutments, piers, guardrails, sign supports, etc.) removed a sufficient distance from the traveled-way to insure reasonable safety? If "No," is the hazard visible for a sufficient distance to present the drivers being startled by it?

| Answer: Yes | No | Comments |
|---|---|---|
| | x | Yes, in the freeway section (I-695). |
| | x | Yes, however, several were not safe. |
| | x | Yes. |
| | x | No. |
| | x | Yes. |
| | x | Yes, there is a conflict in the statements. To a "reasonable" and safe driver - no problem except for unreasonable conditions - ice, fog, snow, etc., exception being a malfunction - tire blowout, etc. |
| | x | Yes, in most instances except for the residential complex. |
| | x | Yes, since it appears to be a continuous hazard potential on this project, drivers appeared to not take note; question should be restated. |

Question: What do you feel is a minimum safe distance from the outside edge of the traveled-way to an obstruction?

| Answer: In feet | Comments |
|---|---|
| 15 | I don't believe that any fixed distance can be set for all conditions. My feeling is to get hazardous objects as far away as practical. |

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| Answer: In feet | Comments |
|---|---|
| 4 to 6 | |
| 20 to 30 | |
| | No distance is safe. |
| 20 | Not considering economic costs. |
| | Depends on type of facility, and the safe speed which is expected to be posted. |
| 15 to 20 | Or at least back of sidewall on urban. |

Question: Does the horizontal alignment along the desired path of travel (particularly reverse curvature) require an excessive amount of driver concentration and thus increase the hazard of other roadway appurtenances?

| Answer: Yes | No | Possibly | Comments |
|---|---|---|---|
| x | | | The "S" curves of the on-ramps. |
| | | | This does require excessive concentration; however, I don't see what other roadway appurtenances have to do with it. |
| | | x | |
| | x | | |
| | | x | |
| x | | | Concentration on radical changes in alignment (vertical and horizontal) could increase hazards, particularly under the conditions of this study. |
| | | x | This would certainly vary with each individual driver's capabilities. |
| | | x | On cloverleaf ramps to freeways drivers were divided in opinions. My own reaction was that it diverted my attention from signs. |

SUMMARY OF DIAGNOSTIC QUESTIONNAIRE RF 606

PILOT STUDY SITE NO. 5 - Urban Route 26 and Expressway I-695

LOCATION: Baltimore, Maryland QUESTIONNAIRE PART: A

AREA: Directional Control 

Question: Is there sufficient advance notification of diverging roadways or turn lanes under light-to-moderate traffic conditions?

| Answer: Yes | No | Comments |
|---|---|---|
| | x | Observed signing at the intersection too small lettering and different background colors confusing -- advance signing for local streets. |
| | x | Not only for the city street signs. |
| x | | |
| x | | |
| | x | Better advance warning signs using a standard symbol message would be very helpful. |
| x | | No problem when route and sufficient knowledge are understood - subject to traffic conditions and density. |
| | x | In this test section there were inadequate street signs, a lack of "conditional" direction on the arterial portions of road. The beltway didn't seem to present a problem. |
| | x | Advance warning to freeway. |

Question: Is there sufficient advance notification of diverging roadways or turn lanes under heavy traffic conditions (i.e., limited lane change capability)?

| Answer: Yes | No | Probably | Comments |
|---|---|---|---|
| | x | | Same as first comment above. |
| | x | | Same as first comment above. |
| | | x | |
| | x | | |

| Answer: | Yes | No | Probably | Comments |
|---|---|---|---|---|
| | | | x | Since traffic was light (on arterials), was unable to determine difficulty. On freeways - the advance signing was adequate - legend not withstanding. |
| | | x | | Observed signing at the intersection--too small lettering and different background colors confusing -- advance signing for local streets. |
| | | x | | Same as comment above. |

Question: Where lane assignments are indicated, are the assignments clear and easily understood?

| Answer: | Yes | No | Comments |
|---|---|---|---|
| | | x | Approach to I-695 "Class Bassey" Westbound 26. Sign indicates lane and assignment "visible" at the curvature (vertical and horizontal) and misleading for lane change (to the left). |
| | | x | Several "directional" arrows on I-695 are misused. |
| | x | | |
| | x | | |
| | x | | |
| | x | | No problem on freeways. |
| | x | | |
| | x | | |
| | | | On approaches to freeway - yes, but not far enough in advance of gore on street intersections. No. |

Question: Do the existing lane assignments result in an unnecessary lane change (i.e., indicate a change to another lane when both lanes continue in the desired direction)?

| Answer: | Yes | No | Comments |
|---|---|---|---|
| | | x | Not to any marked degree. |
| | x | | |
| | | | Do not recall being confused |
| | | x | |
| | | x | |
| | | x | No problem as I recall. |
| | | x | Some instances of this on the Beltway |
| | | | One of the reasons for discontinuing the "THRU TRAFFIC" sign |
| | | | No problem observed on this project, but question should be reviewed. |

Question: Is the exit ramp, turning roadway or turn lane clearly identified and outlined?

| Answer: | Yes | No | Comments |
|---|---|---|---|
| | x | | On I-695 sections. |
| | x | | Yes - on I-695. |
| | | | To the best of my knowledge |
| | | x | |
| | | x | The advance sign and the sign at the exit ramp for Liberty Road west do not have the same message. |
| | | | Except for terminology and instructions. |
| | x | | |
| | x | | |
| | x | | But insufficient advance warning; merging lanes too short; weaving; distance at cloverleafs too short. |

Question: When advisory speeds are posted, are they reasonable in light of the downstream geometric and traffic conditions?

| Answer: Yes | No | Comments |
|---|---|---|
| x | x | Yes for I-695 , and No for Maryland 26. |
| x | | |
| x | | |
| x | | |
| x | | More signs in strategic places could be utilized. |
| x | | |
| x | | No problem noted on this project. |

Question: Are the directional sign messages clear and concise so as to minimize the possibility of driver confusion?

| Answer: Yes | No | Comments |
|---|---|---|
| x | x | On I-695 Yes for local people, No for a stranger. |
| | x | No advance signing for streets. |
| | x | Diagrametric signs would help. |
| x | | |
| | x | See tape for comment on U-turn S. |
| x | | |
| x | | |
| | | See note - clear but too close to departure point. |

SUMMARY OF DIAGNOSTIC QUESTIONNAIRE RF 606

PILOT STUDY SITE NO. 5 Urban Route 26 and Expressway I-695

LOCATION: Baltimore, Maryland QUESTIONNAIRE PART: A

AREA: Occupational Control PAGE 1 of 5

Question: In your opinion, is the sight distance to right-of-way control devices (signals, "STOP" signs, etc.):

/___/Adequate /___/Questionable /___/Inadequate /___/Critical

| Answer: A | Q | I | C | Comments |
|---|---|---|---|---|
| x | x | | | Adequate for signals on MD 26 and questionable for "STOP" signs on the approaches. "STOP" signs are in many cases obscured by other signs and also turned to a degree away. |
| | | x | | For many turns on city streets. |
| x | | | | |
| x | | | | |
| | x | | | Size of street names was very deficient when traveling on MD 26 at 40 mph. Some "STOP" signs on residential streets hidden with shrubs. |
| | x | | | Signs often blocked vision of other control signs. |
| x | | | | |
| | | x | | On this project. See various comments above regarding size and position of messages, lack of advance warning and where advance warnings exist--they are too close to decision points. |

Question: Are the control devices located in positions where they are readily apparent to a normally alert driver?

| Answer: Yes | Possibly | Poorly located | Comments |
|---|---|---|---|
| | | | Locations are probably correct. |
| | | | Orientation and obstructions are not. |
| | | x | Street signs should be on the near right, not on the far right. |

| Answer: | Yes | Possibly | Poorly Located | Comments |
|---|---|---|---|---|
| | | x | | |
| | x | | | |
| | x | | | |
| | | | x | The signals are consistently located over the roadway in the same place (driving lanes or center of driving lanes.) |
| | | | | The "STOP" signs are not at right angles to the driver's eye (taking into consideration glare from the sign). |
| | x | | x | Most signs were located well, but I took exception to signal placement and in many instances, no backup (2 faces). |
| | | | x | Examples: Angle positioned "STOP" signs; signs on left of street; too small letters; too close together. |

Question: Is there sufficient advance warning of devices which are not readily apparent?

| Answer: | Yes | No | Comments |
|---|---|---|---|
| | | x | |
| | | x | No advance for street names. |
| | x | | |
| | x | | In fact, one case, a "SIGNAL AHEAD" sign was located not over 150 feet from the signal that was in plain view - instead of 500-1000 ft. ahead where it was not visible. |
| | x | | Not observed on this project. Question should be retained. |

Question: Are the required speed changes accomplished in a manner which minimizes driver alarm and discourages rapid deceleration?

| Answer: Yes | No | Comments |
|---|---|---|
| | x | Not noticeable. |
| | x | Not for turning on city streets. |
| x | | Some short radii loops. |
| | x | Speed changes were possible, but not when looking for a destination. |
| | x | Poor readability of street names caused erratic driver actions. |
| | x | Not noticed so as to affect my driving or of others. The traffic on the roads controlled my habits. |
| x | | |
| | | On this project, left turn bays and approximate speed change lanes not effective because of absence of advance warning. |

Question: Are adequate speed change areas provided so as to eliminate the need for a substantial speed reduction in the through traffic lanes?

/ / Always / / Usually / / On occasion / / Seldom

| Answer: A | U | OO | S | Comments |
|---|---|---|---|---|
| | x | | | |
| | x | | | |
| | | | x | On right turns from urban street to cross-street. |
| | x | | | Too short weave distance at Beltway Exit to Liberty Road west. |
| | x | | | Variation due only to my inability to make turns - which was not done. |
| | x | | | |
| | | x | | On this project left turn bays and approximate speed change lanes not effective because of absence of advance warning. |

Question: Could sign and/or signal standards be relocated so as to reduce the associated accident potential and still retain an acceptable degree of effectiveness?

| Answer: Yes | No | Possibly | Comments |
|---|---|---|---|
| x | | | Intersecting street signs could be made larger and raised. |
| | x | | Not without reconstruction, especially those in the median. |
| | | x | |
| x | | | Several signal and sign standards could be relocated farther back by use of cantilever standards. |
| x | | | Any fixed object that close to a road is a hazard - span mounted signal should be placed whenever practical. |
| | | x | |
| | | x | If readability is improved. |

Question: Where hazard warnings are provided, can they easily be associated with the hazard involved?

| Answer: Yes | In some cases | Comments |
|---|---|---|
| | x | |
| x | | |
| x | | |
| x | | |
| x | | In most cases. Some severe installations of small sized and improperly located. |

Question: Are warnings provided for hazards which are obvious and for which little, if any, warning is actually required?

| Answer: Yes | In a few cases | No | Comments |
|---|---|---|---|
| x | | | |
| | | x | Do not recall. |
| | x | | |

| Answer: | Yes | In a few cases | No | Comments |
|---|---|---|---|---|
| | | x | | |
| | | | x | Light power poles, fire plugs, sign posts, etc. |

Question: In your opinion, is there a question as to which traffic stream a right-of-way control device applies:

| Answer: | Yes | No | Comments |
|---|---|---|---|
| | x | | "STOP" signs at signalized intersections. |
| | x | | Signal at new four-lane parkway on the left, the left turn lane had no signal ahead. |
| | | x | |
| | | x | |
| | x | | "STOP" signs on several side streets along Liberty Road. |
| | x | | Placement and variation in placement of signal heads was confusing to me - not a uniform method of placement. |
| | x | | "STOP" signs on side streets and signals not oriented to lane used. |
| | | | A green arrow left turn protected lane, no indication of action when arrow is turned off. |

SUMMARY OF DIAGNOSTIC QUESTIONNAIRE RF 606

PILOT STUDY SITE NO. 5 - Urban Route 26 and Expressway I-695

LOCATION: Baltimore, Maryland QUESTIONNAIRE PART: A

AREA: General Information PAGE 1 of 2

Question: Does there appear to be an excessive amount of informational signing within the right-of-way?

| Answer: Yes | Possibly | No | Comments |
|---|---|---|---|
| x | | | Informational, but not directional signing. |
| x | | | When you include all bus zone and parking regulations. |
| | | x | |
| | | x | |
| | x | | Advance exit signs and signs at exit on Beltway do not have same legend. |
| x | | | Too many signs not applicable to a tourist - utilized probably by locals under local ordinances. |
| | | x | |
| x | | | Too many with too small letters - drivers could not possibly read all signs at posted speed limit. |

Question: Is the informational signing provided of real value to a majority of the traffic?

| Answer: Yes | Possibly | No | Comments |
|---|---|---|---|
| | | x | Too much is too much. |
| | | x | Since the majority are repeat drivers, it has no real value to them. |
| | x | | |
| x | | | |
| x | | | |
| | x | | As stated, due to local laws. |

Question: In your opinion, the roadside advertising in this section competes with the traffic control devices for the driver's attention to:

/ / A marked degree  / / Some degree  / / A limited degree

or / / A very limited degree, if at all.

| Answer: | AMD | SD | SLD | AVLD | Comments |
|---|---|---|---|---|---|
| | x | | | | Usual to all "arteries" in majority of the states. |
| | x | | | | In some sections of the route - yes, however, in others, no. |
| | | | | x | |
| | x | | | | Especially when approaching a desired destination. |
| | | x | | | The angle of the restriction signs (no parking, etc.) tends to make the signs smaller; I believe they were too small to start with. |
| | | x | | | In the daytime the commercial signs are not a serious problem. |
| | | x | | | |
| | x | | | | Add questions on sunlight problems late PM and AM. |

SUMMARY OF DIAGNOSTIC QUESTIONNAIRE RF 606

PILOT STUDY SITE NO. 5 - Liberty Road

LOCATION: Just outside Baltimore, Maryland, QUESTIONNAIRE PART: B

AREA: Position Control PAGE 1 of 3

Question: Are the points of divergency from the traffic stream obvious to the normally alert driver a sufficient time in advance of the necessary maneuver such that a smooth, natural transition to the diverging roadway is possible.

| Answer: Yes | No | Comments |
|---|---|---|
| | x | Not by name via signing; markings and geometrics generally were very indicative of points of divergency and were visible for an adequate response time. |
| | x | Because of absence of advance signs, also markings not street names at night due to reflectorized backing.<br><br>Major divergent points are - minor points are not. |
| | x | Street signs are too small at highway speed for a stranger to ascertain. If one could see the signs, one could quite easily make the divergent turn safely. |
| x | | I've answered this questionnaire only as it relates to that portion of the Interstate without street lighting. |
| x | | The signs were more obvious than in the daytime, however, due to small street signs they were still hard to read in adequate advance time. |

Question: Is the normal traveled-way clearly delineated from the parking and/or emergency stopping areas?

| Answer: Yes | No | Comments |
|---|---|---|
| x | | |
| | x | |
| x | | Yes, with few exceptions where cars were parking. |
| x | | |

(continued)

| Answer: Yes | No | Comments |
|---|---|---|
| x | | Yes, on Liberty Road; however, on residential streets there was no delineation whatever. |

Question: Are the roadside hazards visible for a sufficient distance to prevent the driver's being startled by them?

| Answer: Yes | No | Comments |
|---|---|---|
| x | | |
| x | | On the project such potential hazards were continuous.<br><br>Question should be retained. |
| x | | |
| x | | |
| x | | For the hazards that were visible to the driver at night, they were sufficiently marked. |

Question: Does the existing delineation provide a clear and distinct outline of the roadway ahead?

| Answer: Yes | No | Comments |
|---|---|---|
| x | | Standard delineation on I-695 and thru interchange (delineations, edge markings, shoulder materials, geometrics,) delineation by curbing, other signs and roadside development and markings did job adequately on Liberty Road. |
| | x | |
| x | | Yes, on the freeway, on the city streets, one could see the road outline by the curbs - very little artificial delineation. |
| x | | |
| x | | |

Question: Is the illumination provided by the vehicle's headlights sufficient for safe operation on this facility?

| Answer: Yes | No | Comments |
|---|---|---|
| x | | |
| x | | In most locations. |
| | | Neither, this is a city main highway. There are pedestrians - therefore, you need street lights. |
| x | | At the speeds driven in this test when the route was known sufficiently in advance. |
| x | | |
| x | | |

Question: Does the glare from opposing headlights obscure the driver's view of the roadway ahead?

/ /Probably / /Possibly / /Not to any marked degree

| Answer: P | P | NMD | Comments |
|---|---|---|---|
| | | x | |
| x | | | Partially in some locations create sign reading problems, especially on left. |
| | | x | High beams only. |
| x | | | Not only the headlights - but the brilliance of the advertising signs was extremely confusing - especially when looking for street name signs. |
| | | x | |
| | | x | |

SUMMARY OF DIAGNOSTIC QUESTIONNAIRE RF 606

PILOT STUDY SITE NO. 5 Liberty Road

LOCATION: Just outside Baltimore, Maryland QUESTIONNAIRE PART: B

AREA: Directional Control 

Question: Is there sufficient advance notification of diverging roadways or turn lanes?

| Answer: Yes | No | Comments |
|---|---|---|
| | x | Not at all on Liberty Road. Apparently standard display and adequate on I-695. On Liberty Road the problem was no worse because of darkness and further was especially poor for the left turn maneuver. |
| | x | No advance notification in most cases to identify intersections. Street names too small, some improvement in readability over daytime conditions. |
| x | | Main roadways only. |
| x | x | Yes, on freeways but not on the required left turns for arterial streets. |
| x | | |
| | x | Not for turning into city streets. |

Question: Can the existing directional signs be easily read at a glance?

| Answer: Yes | No | Comments |
|---|---|---|
| | x | Generally not, especially on Liberty Road. |
| | x | Letters too small. Few state highway route markers. |
| x | | |
| x | | On the freeways. |
| x | | |
| x | | |

Question: Is the existing lane delineation adequate?

| Answer: Yes | No | Comments |
|---|---|---|
| x | | Exception for strangers - might be the fifth lane two direction left turn. |
| x | | Except visibility diminished at night compared to day. |
| x | | For good weather only. Positively not on rainy nights. |
| x | | Yes, I was surprised to see the lane markings on the city's subdivision streets. Very good. |
| x | | |
| x | | On the Interstate and Liberty Road (new section), however, there is no lane delineation on the residential area. |

Question: Does the glare from opposing headlights make it difficult to read roadside and/or overhead signs?

| Answer: Yes | No | Comments |
|---|---|---|
| | x | To some degree on this project, however, there were no overhead signs. This is a good question to retain. |
| x | | |
| x | | |
| x | x | The overhead signs on the freeways were easily read (illuminated or not). It was very difficult to read roadside signs (particularly street names) because of the opposing glare in some instances. |
| | x | |
| | x | |

SUMMARY OF DIAGNOSTIC QUESTIONNAIRE RF 606

PILOT STUDY SITE NO: 5 - LIBERTY ROAD

LOCATION: Just outside Baltimore, Maryland QUESTIONNAIRE PART: B

AREA: Occupational Control PAGE 1 of 2

Question: In your opinion, is the sight distance to right-of-way control devices at night: A--Adequate, Q--Questionable, I--Inadequate, C--Critical?

/ /Adequate / /Questionable / / Inadequate / /Critical

| Answer: A | Q | I | C | Comments |
|---|---|---|---|---|
| x | | | | |
| | | | x | Not far enough in advance of decision point; messages too small. |
| x | | | | |
| | x | | | Some control signs hidden at key locations. |
| x | | | | |
| x | | | | |

Question: Where hazard warnings are provided, can they be easily associated with the hazard involved?

| Answer: Yes | No | Comments |
|---|---|---|
| x | | Generally so. |
| x | | |
| x | | |
| | x | At night many of the hazards are not visible. |

Question: Do signs and lights outside the right-of-way detract to a marked degree from the effectiveness of traffic control devices?

| Answer: Yes | No | Comments |
|---|---|---|
| | x | I will have to answer no. probably because of my familiarity with the area. |
| x | | This project is typical of the strip development consisting of service and retail businesses open at night and in competition with each other. |

| Answer: | Yes | No | Comments |
|---|---|---|---|
| | x | | The effects of such gaudy lighting on traffic should be relentlessly pursued in these studies. |
| | x | | Yes - where the fringe development is a honky-tonk section. The reflectorized line striping will not reflect during rain, I suggest that an additional reflectorized glob of thermoplastic be dropped on the painted line or in the skip sections. This glob could be approximately two or more inches in diameter and about .25" or .3" thickness (see sketch on questionnaire). This should be researched for proper dimensions. |
| | x | | Definitely as specified in previous questions; they detract considerably from observing the important control signs. |
| | x | | |
| | x | | |

APPENDIX "C"

SUMMARY OF TECHNICAL INTERVIEWS

PILOT SITE NO. 5 MD 26 (LIBERTY ROAD) BALTIMORE, MARYLAND

## GEOMETRIC DESIGN

### DAY PHASE

The high curbs and lane width bother me.

While driving in the right lane, you feel very hemmed in.

The high vertical curbs on Liberty Road may tend to keep driver towards the center lane.

Liberty Road has 11-foot lanes and a 16-foot median which should be changed.

The curb section does not interfere with my driving.

These are steep curbs (interchange ramp).

The mixing of diamond and cloverleaf interchanges is confusing.

I don't like to see curbs next to the fast lane.

If this is a one-lane ramp, then the high curbs do not bother me.

This could be a narrow two-lane ramp or a wide one-lane ramp.

### NIGHT PHASE

The narrow width of this lane does not bother me, because I am used to it.

This road should not have parking on it the way it now operates, because we confuse the driver as to when he can park.

I do not mind the high curbs (Interchange Ramp ).

## SIGNING

### DAY PHASE

If "LIBERTY ROAD" sign were in the concrete divider, I would not have made the wrong turn (at Washington Ave.).

There is a lack of speed limit signing.

### NIGHT PHASE

I wonder if the average driver can judge a distance of one-sixth of a mile (at I-695 Interchange).

The street name signs should be on the near right on both sides of the street (at Washington Avenue).

(Signing continued)

DAY PHASE

I know that there is a frontage road over there (at Washington Avenue).

One-way sign over there is misleading (at Washington Avenue).

I notice that they have "STOP" signs in conjunction with signals.

The only reason I saw the "CROYDEN" sign is because I had to stop for the signal.

I completely missed the sign for Patterson.

The "CROYDEN" sign is not easy to see because of all the signs around it.

The street name signs are too small.

The angle of the "STOP" signs may confuse a driver.

I just barely saw the "CROYDEN" sign. The message on the street name signs is too small for the speed.

I don't know what road that was (Croyden).

When you enter a residential area, there is no posted speed limit.

The "STOP" signs are not perpendicular to the side streets.

The only reason that I know to turn here (Patterson) was because I had been over this route before. They need larger street name signs placed on the near side of the intersection.

If I had been going to Patterson St., I would have looked at a map to get its general location. On a heavily traveled street you have too many things to do, and you don't have time to look for a street name sign.

NIGHT PHASE

Which roadway is Liberty Road and which one is the frontage road (at Washington Avenue).

I could see the "MAYFAIR" sign better than the "CROYDEN" sign.

There are just too many signs in this area.

You can hardly see the "LIBERTY ROAD" sign.

The "STOP" signs need to be turned at right angle to the intersecting street.

Do you think that I will be able to see Croyden at night when I could not see it in the daytime? I saw the "CROYDEN" sign too late to react.

The canted "STOP" signs do not bother me, but I do like the way they have been placed.

The street name signs are much more visible at night, but they are still inadequate in size.

Where you have left-turn bays, you should have some type of advance warning for the intersection.

I can see the street name signs, but I am only driving 30 mph.

The street name signs are too small, and they are blurred, especially since they are reflectorized.

I did not see the street name sign at Patterson.

It is easier to drive this route at night, because of the lighter amount of traffic and the fact that the street name signs are easier to read.

At speeds over 30 mph, I cannot see the street name signs in time to make the turn.

(Signing continued)

DAY PHASE

There is Patterson street on the left and I am not in position to make the left turn because I could not see the street name sign in time.

Not many markers have been placed because the local people know this as Liberty Road and not MD 26.

I am unable to maintain the 40 mph speed and read the street name signs.

The only reason that I know this is Patterson is because I have been over the route several times.

I missed Powder Mill Lane, because I did not see the sign in time to make the turn.

There are limited state route marker signs on Liberty Road.

It is most difficult to read the street name signs, because the legend and size are too small.

I could read the street name signs at 30 mph, if they were located the same at each intersection

The placement of the street name signs is not effective, and the signs are inadequate in size.

On a main highway, the street name signs should be double their present size.

The street name signs are extremely small. I find myself slowing down at each intersection in an attempt to read the sign.

There is not any signing for the Northern Parkway.

There is no left-turn arrow for Northern Parkway and queues of 30 to 40 vehicles are common on Liberty Road.

NIGHT PHASE

If it is worth putting a route marker up, it is worth putting a cardinal direction on the sign.

Turning the signs at an angle reduces the target value of the sign.

I can see that street name sign "CAMP-FIELD" just about 100 feet in advance. They need to increase the letter height about 2 inches.

There are too many signs on this route. We have a lot of laws that we do not sign for.

I know that this was Campfield, because I remembered the location.

I can read the signs when I get close to them.

"EMERGENCY STOPPING ONLY" should not have to be signed for.

The interchange sequence signs are in the wrong location. Interchange sequence signing is real good, but it should be located away from other signing.

We are going to have to develop some type of symbolic sign to convey interchange layout.

I don't like the idea of having warning signs for Liberty Road and no reference to Liberty Road at the interchange.

Street name signs are easier to read at night.

(Signing continued)

DAY PHASE

NIGHT PHASE

All of the signs along Liberty Road are set at an angle.

The signs are set at an angle because of the double-headed arrow (parking signs); all other signs should be 90 degrees plus or minus 3 degrees for reflection.

They need a direction (east or west) on the S.H. 26 route marker sign (intersection of Rogers and Liberty Road).

When I can read the sign, I am too close to make the turn.

You must slow down to 10 to 15 mph to read the street name signs.

There is a change in the type of street name sign here, because we are in Baltimore.

There are too many signs in this area. The signs are all turned sideways, which in effect makes them smaller.

MD 26 route marker signs are needed at intersecting streets such as Patterson (county routes or major streets).

The route does lack confirmation markers.

I wish there was a better way to convey parking regulations.

We are used to reading the large freeway signs and can't adjust to the small street name signs.

There is no reference to Liberty Road on the overhead sign.

Larger trunk line designation signs are needed (I-695 Beltway).

That down arrow on the overhead sign should not be there.

The directional sign helps in the decision process.

(Signing cont'd)

DAY PHASE

A tie between MD 26 and Liberty Road signing is needed.

How do I know what kind of an interchange is ahead?

We should provide the driver with some idea of the configuration of the interchange.

Some of these signs are a pale green and do not give good contrast.

Street name signs are too small.

Street name signs need to be larger and advance street name signs would be beneficial

NIGHT PHASE

## PAVEMENT MARKINGS

DAY PHASE

Turned onto frontage road instead of Liberty Road because did not notice the painted island on Liberty Road ( at Washington Avenue).

I can see where the frontage road separation is very confusing.

These pavement markings for the median and left-turn slots are confusing. It looks like they left the old centerline in and used double yellow lines to outline the island

I am impreseed by the left-turn facilities without the use of a concrete island.

They have fallen short in not educating the public as to the meaning of our signs and markings

I don't see anything wrong with the way the left-turn bays are placed although you might lose the pavement markings in the rain.

NIGHT PHASE

The center median area should be marked for left-turns, if they are to be allowed.

I would like to see buttons used in conjunction with the centerline striping and left-turn bays.

This island could use some reflectorization (MD 140 Interchange).

## SIGNALIZATION, ILLUMINATION AND GLARE

### DAY PHASE

I object to the use of a "STOP" sign with a traffic signal.

The sun gives me trouble with viewing of the traffic signal.

That is an unusual spread on the signal heads (Patterson Avenue).

The signal head is far to the left.

The signals seem to be out of alignment (Patterson).

These traffic signal arrangements are confusing (at Patterson).

The street lights are all on one side of the roadway.

### NIGHT PHASE

This is a pretty well lighted intersection. They do have enough luminaires in through there. There is a lack of route marker signs on Liberty Road.

I do not experience any glare from the street lights; they do not bother me.

This signal head has been misplaced (Patterson).

I am not too sure that illumination of the roadway helps the safety.

There is a lot of interference from commercial lighting at this location (near Campfield).

The left-turn lane is not effective unless you give it a signal phase.

This street lighting is not uniform.

Lighting would help me here (Security Blvd).

The fact that there is no illumination on this straight section does not bother me.

I do not miss continuous lighting on the straight freeway section.

## DELINEATION

### DAY PHASE

### NIGHT PHASE

I see the reflectors on the ramp at night, where I did not notice them in the daytime. Also, I do not notice the high curbs at night.