TECHNICAL MEMORANDUM

DIAGNOSTIC STUDIES OF HIGHWAY VISUAL COMMUNICATION SYSTEMS

HPR-2(108)

STUDY SITE NO. 13

GRAND RIVER AVE. (BR-96) DETROIT, MICHIGAN

TM2(108)-13

STUDY SITE CHARACTERISTICS

GENERAL CHARACTERISTICS

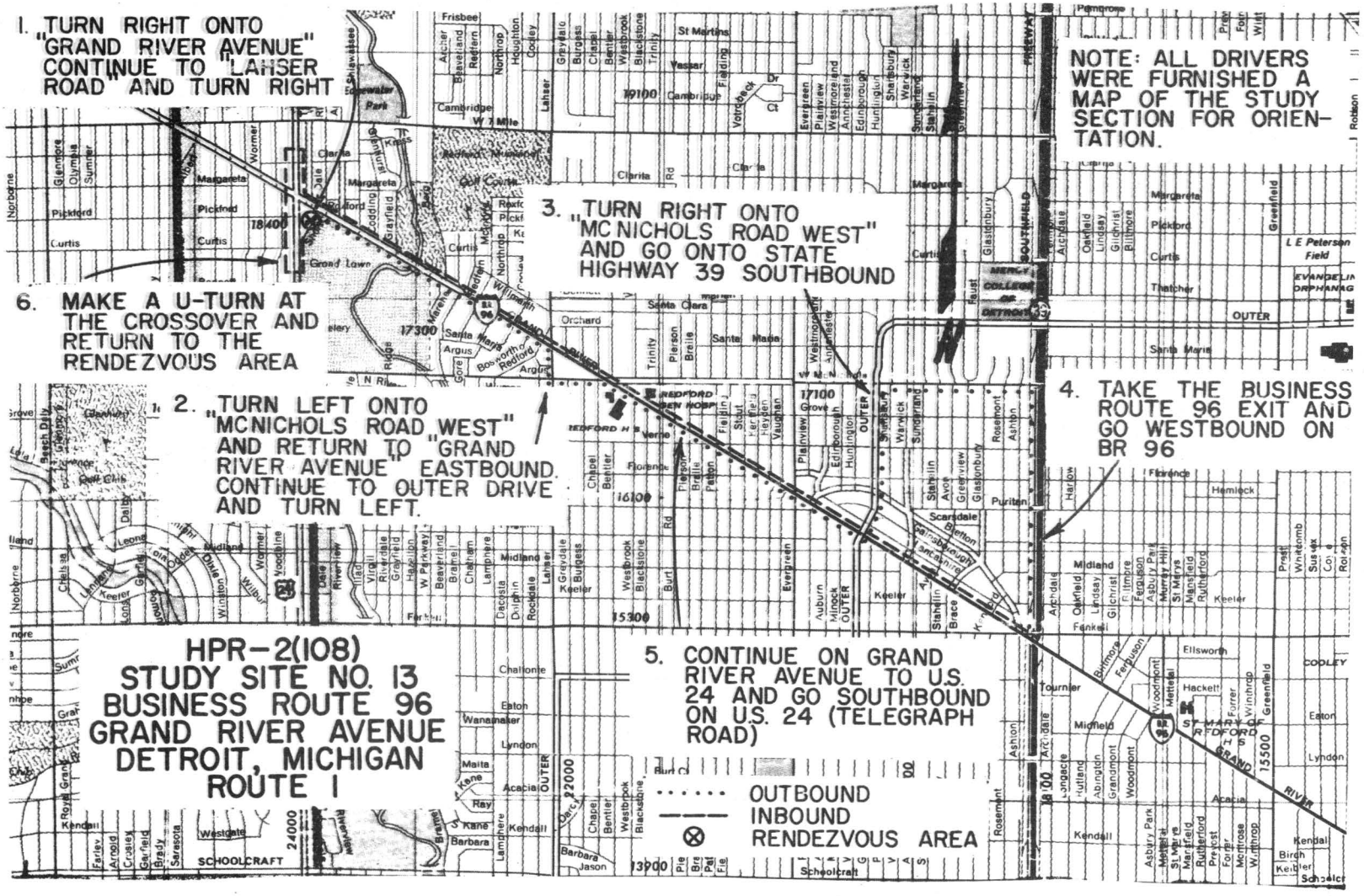
A three and one-half mile section of Grand River Ave. on the northwest side of the city of Detroit, Michigan, was selected as an arterial street which contains several different types of operations within the basic study section. The study section begins at Telegraph Road, U.S. Highway 24 and proceeded southeastward to the interchange with the Southfield Freeway, Michigan State Route 39. The field studies on this site were conducted during the week of July 14-18, 1969. The weather conditions throughout the study period were clear and relatively hot.

The diagnostic team assembled for this study was composed of individuals with the following occupations:

A Michigan State Policeman,
A Traffic Engineer from the State of California,
An Engineer of Traffic and Safety for the Michigan Highway Department,
A State Safety Commission Executive for the State of Michigan,
A representative from the Automobile Club of Michigan.

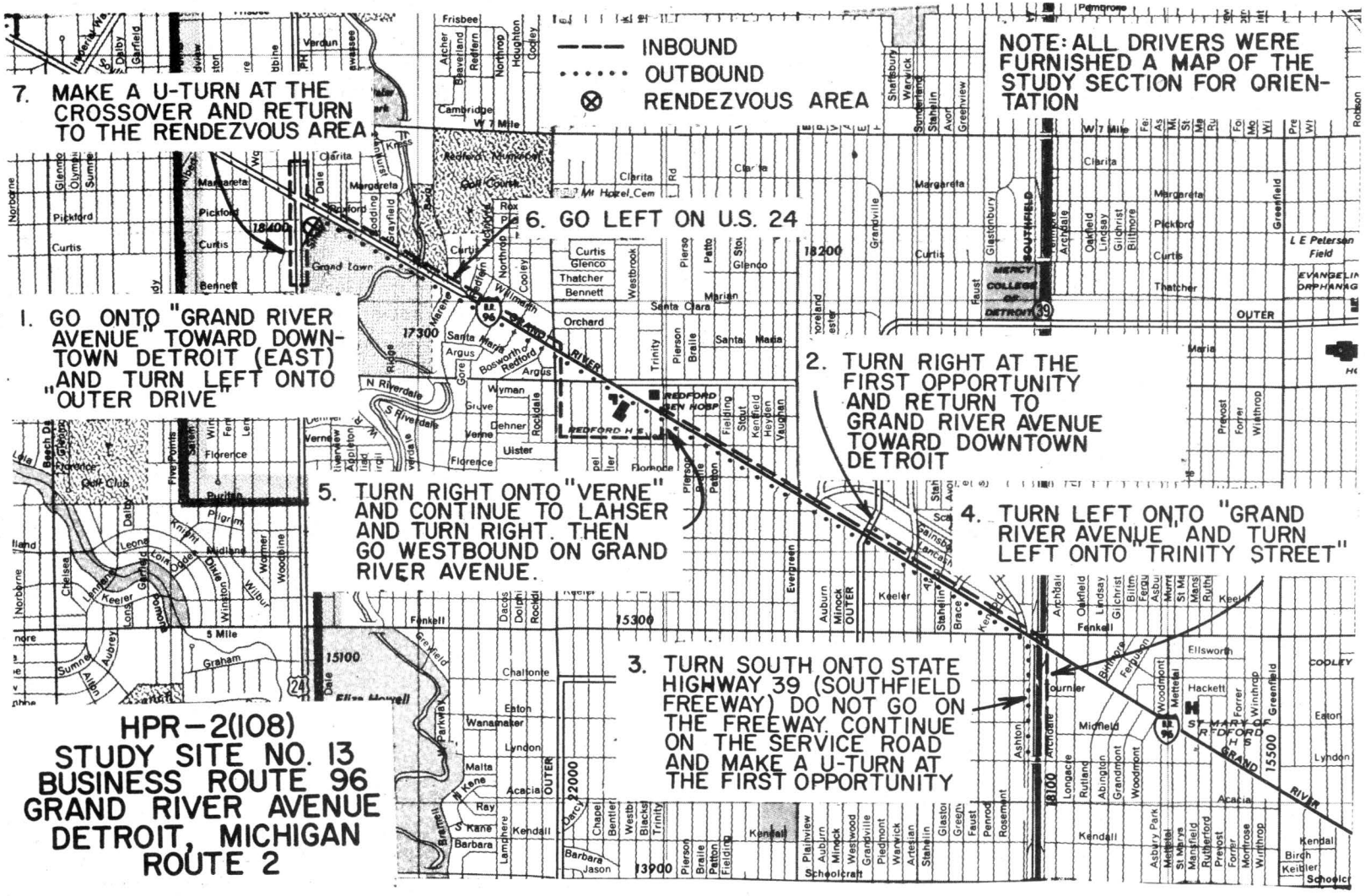
This team composition represents a rather broad cross section of driver capabilities and technical background and thus, seems to offer the inter-disciplinary nature required of a diagnostic team.

This study section could best be described as a major urban arterial street. The study section was 3.54 miles in length and contained numerous major intersecting roadways. There were nine signalized intersections within the study section. The signals were predominantly mast-arm mounted but a few were span-arm mounted. This site consists of a divided seven-lane cross section near the west end and an undivided five-lane facility in the eastern two-thirds of the study section. The five-lane section is converted to six lanes by removal of parking during the peak hours and the center lane is reversible for the same time period. There were two very complex signalized intersections; the first one was at the intersection of West McNichols, Grand River, Bentler, and Chapel. The second was at the intersection of the Southfield Freeway with Fenkell Ave., Ashton St. and Grand River Ave. The development along the study section could best be described as strip commercial development somewhat less intense on the west end than on the east end, but rather continuous throughout the entire study section. All of the intersections with the exception of the interchange with the Southfield Freeway are at-grade and the section is curbed throughout its length. Parking is permitted on both sides of the roadway throughout the study section. Intersecting roadways are controlled either by signals or stop signs. A strip map of the study section is shown in Figures 1 and 2.



STRIP MAP OF STUDY SITE 13 INDICATING DRIVING ROUTE 1

FIGURE 1



STRIP MAP OF STUDY SITE 13 INDICATING DRIVING ROUTE 2

FIGURE 2

DESCRIPTION OF TRAFFIC CONTROL

Markings--The pavement markings throughout the study section could be considered typical of urban arterial streets. The only point of possible confusion with regard to the pavement markings dealt with the center lane of the five-lane cross section from Lahser to Southfield Freeway. This lane is used both as a left turn bay during the off peak hours and as a reversible lane during the peak period. The pavement markings are typical of left turn situations and gave no indication of the reversible operation. Stop bars were provided at all signalized intersections and at a few intersections, supplementary pavement arrows were used in the intersection to guide left turning traffic.

Signing--The study section contained numerous regulatory signs which were applicable to operation on that facility. The most notable was the large number of speed limit signs and the very large number of "NO PARKING" signs. Span-wire mounted overhead signing was provided to advise the motorist of the reversible lane situation in the eastern two-thirds of the study section. There were directional plates to downtown Detroit and to the toll bridge and tunnel which connect Detroit with Windsor, Canada. Interstate business shields for Business Route 96 are located throughout the study section.

The street-name signs used to identify intersecting roadways were composed of three inch black letters on a white background. When the street-names on opposite sides of the street were different, both names were posted on each street sign and an arrow pointing in the appropriate direction was used to supplement the basic street-name message. No advance signing for the major intersections is provided with the exception of the intersection with Telegraph Rd. (U.S. Highway 24).

Traffic Signals--The traffic signals used throughout the study section were mast-arm mounted on the near side of the intersection, with a supplementary head on the post on the far side of the intersection. The lenses on the traffic signals used throughout the study section were eight inch lenses, and there was very limited use of special turn arrows.

TRAFFIC AND ACCIDENT CHARACTERISTICS

Traffic volume data and accident data on the study section were not available. On driving the study section, it appears that the traffic load is relatively heavy throughout the day and well into the evening.

The posted speed throughout the study section varies from 45 mph in the west-end divided section to 35 mph on the eastern two-thirds of the study site. The running speed during the off-peak period seemed to conform rather well to the posted limit. However, during the peak period the major flow will tend to exceed the posted limit when the traffic conditions permit.

DIAGNOSTIC TEAM REVIEW

STUDY SITE NO. 13; GRAND RIVER AVE.; DETROIT, MICHIGAN

SUGGESTED DESIGN IMPROVEMENTS

The diagnostic team members felt that the most serious geometric problem on the study section was the intersection of Fenkell Ave., Grand River Ave., and the Southfield Freeway. The driver approaching the at-grade intersections with Fenkell and Grand River is presented with a relatively complex intersection which is extremely confusing. The driver is looking for Grand River Ave.; there is a tendency for him to make the right turn and go down Fenkell Ave. rather than making the two right turns to go to Grand River. Channelization of the intersection was suggested in order to more clearly direct traffic to Grand River Ave.; however, this was felt to be impossible due to the effect on other traffic and adjacent property. It was suggested that possibly a sign with the message "GRAND RIVER AVE. TRAFFIC KEEP RIGHT" on the service road approaching the Fenkell-Grand River intersection might be effective in conveying the message to the driver. Another team member felt that the sign should be placed overhead due to the relatively large number of lanes approaching the intersection at this point and the extremely short weaving distance from the ramp on the left to the right turn maneuver on the far right. It was also suggested that the overhead sign might effectively use diagrammatic signing due to the relatively complex nature of the maneuvers that can be made from the southbound approach.

The transition from the reversible lane operation on the eastern two-thirds of the study section to the divided section on the west-end of the study section did not appear to be a problem to the team members. The team members felt that this was probably due to the widening from three to four lanes at the transition.

The left turn maneuver from Grand River Ave. onto Telegraph Rd. (U.S. 24) was considered by the team to be a definite problem for the unfamiliar driver. The maneuver required that a right turn be made at the intersection of Grand River and Telegraph Rd., a transition be made across three lanes of traffic into a U-turn slot through the median, and then preceeding back through the signalized intersection. The problem appeared to be one more of driver expectation than of geometric design or signing. The driver simply did not expect to make a right turn in order to go left and as a result did not believe the signing in place. This situation created considerable confusion on the part of the driver as the expected maneuver and the maneuver he was told to execute did not correspond. There was, however, a secondary method of making the left turn maneuver beyond the intersection, the driver could make a U-turn through the median and then the right turn onto Telegraph Rd.

One of the team members thought that a new terminology should be instigated in order to describe the maneuver required. For example, the terms "loop turns" or "left loop turn" or "loop left turn" were suggested as possible phrases which would convey the necessary meaning to the driver. Other

team members felt that a diagrammatic approach to the maneuver would be more easily understood by the driver and therefore more effective in conveying the message.

Another feature of the roadway which seemed to be confusing to some of the team members, was the combination of the U-turn slot provided in advance of a signalized intersection with Grand River on the service roads to the Southfield Freeway. On the east frontage road, going northbound, the sign indicates that the left lane must turn left only and immediately afterward is the U-turn slot. One driver felt that the left turn only requirement was for the left turn slot rather than the intersection proper. It was his feeling that when a left turn only instruction was given, then this instruction applies to the next intersecting roadway rather than the major intersection ahead or a signalized intersection ahead. It was suggested that under circumstances such as this, a special maneuver should be required in order to get into the U-turn slot. This might entail adding a short section of lane in advance of the U-turn slot into which the driver must make a positive maneuver if he wished to make the U-turn.

The parking lanes were of concern to the diagnostic team. One of the team members thought that the parking lanes should be segregated in some distinct way, either by a stripe or a broken stripe and perhaps by a different color to indicate that this represents the edge of the travel portion of the roadway. This is a problem as during certain portions of the day, the lane is used for moving traffic and during other portions of the day, it is used for parking vehicles. If the lane is clear and parking is permitted, then a driver following another vehicle will find himself trapped by a parked vehicle very quickly. It was suggested that some unique method of identifying the right lane (curb lane) as a combination running lane and parking lane be utilized.

The team members comments regarding traffic signals indicated that for the most part they felt they were visible and did not create any particular problems for the driver. The only installation that seems to create difficulty for the driver was the pedestrian signal just east of the intersection of McNichols and Grand River Ave. (Making the right turn from McNichols Ave. to go eastbound onto Grand River Ave. toward downtown Detroit.) This signal comes immediately after the turn and the driver simply does not expect a stop condition immediately after passing through a signalized intersection. The sign in advance of the intersection on McNichols Rd. advises the driver to "BE PREPARED TO STOP AFTER RIGHT TURN" but the maneuver is so unusual that the driver simply did not interpret the message properly. A suggestion was forwarded that possibly the pedestrian signal should be turned off after school hours and during the summer. It was the general feeling of the team that the erratic operation would create a greater chance of violation and therefore more difficulty than if it were allowed to operate on a constant basis. It was also pointed out that any recommendation or suggestions regarding the alteration of the signal should follow a relatively detailed traffic engineering study of the intersection requirements. It was pointed out, however, that the intersection of Grand River, McNichols West, Chapel,

and Bentler was already a complex intersection requiring extreme driver concentration; and the addition of the pedestrian signal only creates more problems for the driver. One of the team members felt that the only logical solution would be a pedestrian overpass structure. This idea was not favorably received by the majority of the diagnostic team. The major concerns of the signing on the study section dealt with three problems: (1) the signing on the approaches to the interchange with Fenkell and Grand River Ave. from the Southfield Freeway, (2) the frequency of parking signs throughout the study section and (3) the signing for the reversible flow and the center lane in the eastern two-thirds of the study section. On the approaches to the Grand River, Fenkell intersection from the Southfield Freeway, it was suggested that an overhead sign indicating Grand River and Fenkell with the arrows and also route numbers on the service roads would be desirable. One of the team members, however, felt that this problem was exaggerated and did not feel that it would be worth the expense involved to solve the minor problem. It was his opinion that there would not be enough people getting lost at this point to worry about.

The frequency of parking signs along Grand River Ave. was considered to be excessive by the team members and they tended to detract from the more important signs. It was the general consensus of opinion that two parking signs per block of normal length and three signs for block of unusual length would be sufficient in most cases. The suggestion was put forth that possibly a sign at the beginning of a block which says "NO PARKING THIS BLOCK" or a sign similar to "MAJOR STREET - NO PARKING" might be effective in conveying the information to the driver. It was a general consensus of the team that one sign per block would not be sufficient to insure that the driver was informed regarding the parking regulation and that the standard parking signs located at the beginning and the end of the block would be more desirable. The problem of identifying the reversible lane was noted by the team members and there was a feeling that the driver relies more heavily on the pavement markings than on the signing in identifying the type of operation of the center lane. The existing pavement markings tend to indicate the left turn bay rather than reversible lane operation and, therefore, could be a problem for the unfamiliar driver. It was noted by some of the team members familiar with the study section that when the reversible lane is in operation, there is little doubt as to the situation and , therefore, few if any difficulties with the reversible operation will actually occur.

Regarding the illumination provided along Grand River Ave., none of the team members reported glare problems associated with the roadway lighting. One team member noted that the latter effect of driving in and out of the illuminated areas was somewhat disconcerting to him. He felt that it would be better if there was greater overlap of the lighted areas. There was a general consensus of opinion that the main problems with illumination were associated with the commercial lighting. In particular, the large number of incandescent bulbs in a row used by used car lots to attract attention, seemed to be particularly difficult for the driver. It was suggested that

some regulation regarding the level of glare from commercial signing be utilized to minimize this problem.

The delineation of the roadway was considered, in general, to be quite good. The only problems reported by the team dealt with locating the crossovers on the divided portion of the study section. It was suggested that delineation or fixed lighting be added in order to more positively identify the location of the crossovers and therefore reduce the possibility of rear-end collisions while the driver is searching for the crossover area.

There was some discussion of the use of supplementary pavement markings in the study section. However, it was generally concluded that the reversible lane eliminated the possibility of effective use of left turn arrows and the snow and ice problems during the winter months make the pavement markings totally ineffective. It was, therefore, concluded that probably the use of supplementary markings should be kept to a minimum on the study section.

APPENDIX

A - Description of Study Procedures

B - Summary of Diagnostic Questionnaires

C - Summary of Driver Interviews

APPENDIX "B"

SUMMARY OF THE DIAGNOSTIC QUESTIONNAIRES

Study Site 13; Business Route 96, Grand River Ave.; Detroit, Michigan

The following is a detailed presentation of the comments made by the diagnostic team members on the diagnostic questionnaires, concerning daylight conditions.

DAY PHASE

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

Yes	No	Comments
x		A dip in the road as the highway divided, left about 100 yds. invisible on Grand River Ave.
	x	For the density and speed of traffic, I did not lose visual contact with the roadway surface to the extent of being concerned.
x		In checking for street signs, loss of contact was made looking for signs.
x		At several crossings in narrow residential streets, the crown of the cross street raised my sight line. Also, the need to hunt for street and control signs caused me to lose eye contact with the road surface at many points.
	x	There weren't many changes in vertical or horizontal alignment.
	x	Unless blocked vision by large trucks and busses is considered. Bad in right lane, which most of them use.

What treatment, if any, would you recommend to improve this situation?

Larger signs.

Improve pavement, strengthen lane lines, and replan sign location and visibility to conform more to the normal sighting of driver behind the wheel.

Question: How would you evaluate the importance of being able to continuously see the roadway surface while driving?

/___/ Of Little Importance

/___/ Of Some Importance

/___/ Relatively Important

/___/ Critical Problem

OLI	OSI	RI	CP	Comments
		x		To get the big picture, one must be able to see all ahead even with a glare.
		x		I am sure a motorist is "comfortable" driving if he can see the roadway surface ahead. Although the Southfield Expressway has a "rolling profile," the exits are in view in ample time to make the exit movement.
		x		Would be like closing eyes for a second or so while driving.
		x		Holes in pavement can defect direction of vehicle, cause sideswipes, etc. Lanes can merge or change direction while driver is temporarily distracted. Directive lanes might go unobserved until it is too late.
		x		
		x		This is related to speed and would be critical for operating speeds above 60 mph.

Question: Do you, as a driver, feel that the turn lanes are obvious in time for a reasonably alert driver to make a smooth, natural maneuver into them?

Yes	No	Comments
x		Turn lanes were well marked and adequately placed.

Yes	No	Comments
x		Yes, if you can locate your turn far enough in advance.
x		Position of lane is important.
	x	This varies with location. However, in today's conditions, lane markings must be started earlier, be maintained brightly (or reflectorized), and be reinforced by overhead signs.
x		
x		The lane lines are visible, but street-names are not visible in time to move into reserved turning lanes.

Question: Does the driver appear to have difficulty in maintaining the vehicle within the marked lane (i.e., does he tend to move over into adjacent lanes)? (Answers: Yes; NAD--Not to Any Appreciable Degree).

Yes	NAD	Comments
	x	
	x	On eastbound Grand River, I felt the lane next to the parked cars was narrow. Width of other lanes did not disturb me.
x		This was due to parked vehicles.
	x	While I was observer of my driver, he complained that the lane markings were poorly maintained, except in the center turning and express lane (Grand River Ave.), but he kept in place with the instinct of a good driver.
	x	
x		Inside lane on curbed median and outside lanes adjacent to parked cars did not appear to be acceptable. It appeared to be about 10' wide. Parking lanes were not marked.

Question: Are the through lanes clearly identifiable from the parking lane?

Yes	No	Comments
x		But Grand River's outside through lane seemed narrow because it was adjacent to the parking lane.
	x	Parking lanes were not marked as such. In the divided section east of Telegraph, parking is permitted in some areas which tends to trap a thru motorist in the curb lane.
	x	Should be some warning.
	x	As I observed it, the parking lane was not separated fromthe traffic by any markings.
	x	Markings of some type are desirable to mark the edge of the main travelled-way to separate it from the parking areas. I don't think that this type of marking is a critical problem.
	x	Insofar as marking is concerned; yes, as signing is concerned.

Question: Does there appear to be a substantial number of vehicles driving partially in the parking lane?

Yes	No	Comments
	x	
	x	Most of the drivers are "Detroit oriented" and know they may be trapped in the parking lane. The driver that I observed did get trapped in the parking lane westbound on Grand River approaching Telegraph Rd.
x		At times.
	x	
x		When people drove with their right wheels in the parking areas, they seemed to know what they were doing. With an edgeline they would know for sure. It may be good for them to encroach when there are no parked vehicles.

Yes	No	Comments
x	x	No, in motored areas; yes, in other areas.

Question: Are the roadside hazards (bridge abutments, piers, guardrail, sign posts, etc.) removed a sufficient distance from the through lanes to insure reasonable safety? If "No," are the hazards visible for a sufficient distance to prevent the driver's being startled by them?

Yes	No	Comments
x		And signed.
x		I was not even aware of such roadside hazards, and when a row of poles was called to my attention they still did not disturb me.
x		City drivers would be more aware that the sidewalk and curbs are only a few feet or inches from the driving lane and can therefore compensate with skill. This would diminish if personal controls were diminished by drinking, physical defects, and so on.
	x	There were lots of light standards, power poles and three which were too close to the edge of the roadway. Some were not essential.
x		Power poles in medians could be hazardous during extremely low traffic when speeds higher than 35 mph prevail.

Question: What do you feel is a minimum safe distance from the outside edge of the through lane or from the curb to an obstruction?

Feet	Comments
3	
2	With 6" - 8" vertical curb face, the curb itself forms a minor obstruction and gives a psychological effect of insulating the motorist from the larger obstruction.
4	

Feet	Comments
6	Purely opinion. In some instances, drivers leave the road to a distance of 50 or more feet and hit some object or ditch, wall, etc.
	The minimum lateral distance to obstructions from the edge of the travelled-way depends upon speed and whether there is a clear recovery area. If there is a recovery area on a freeway (60-75 mph), 30 feet seems OK. In metropolitan areas, city street sections didn't require that much. Ten to 15 feet should be ample at 20-25 mph in town.
	Ten to Twenty feet for a 35 mph speed limit which prevails on most of this project and up to 30 feet for higher speeds.

Question: Do the curves require an excessive amount of driver concentration and thus increase the hazard of other objects along the roadway? (Answers: Yes; No; Poss--Possibly)

Yes	No	Poss.	Comments
	x		
		x	This would possibly be true at the directional crossovers along Telegraph Rd. and Grand River divided sections.
	x		
		x	Did not experience this myself on my trip, except that I almost missed a red light around the corner from McNichols on Grand River.
x			There weren't many curves on this road, but the statement that curves distract the driver from reading signs is probably true.
			No curves.

Question: Does the development and its associated activities along the roadside distract you to any appreciable degree? (Answers: Yes; No; SBNC--Some but not of concern)

Yes	No	SBNC	Comments
x			Maze of signs, signals, trucks, and parked cars do cause some concern to me.
		x	Parking control signs and some advertising signs formed a distraction and barrier to observing street-name signs.
x			People jaywalking and some flashing signs.
x			I find that I can not let myself be distracted by side views, or I tend to move into "close shaves" in traffic. Whether this is due to increasing traffic volume or to the natural deterioration of sight and reaction, I am not sure. Anyhow, I have to keep my eyes on the road and my mind on my driving to be safe.
x			The development and excessive number of signs on Grand River Ave. made it difficult to spot street-names and other signs.
x			In areas where parking is permitted.

Question: Is there sufficient advance notification of cross streets to permit proper utilization of the turn lanes provided?

Yes	No	Comments
	x	Major intersections perhaps, but for one searching for signs, he finds them blocked by poles or are set back too far from the intersection.
	x	It appears Detroit has tried to be somewhat uniform in the location of street-names.
	x	No advance notification is given.
	x	Some main crossings have good advance warning. However, most need improvement.
	x	There was no advance signing to major cross roads. The street signs were very small.

Yes	No	Comments
	x	Two out of three drivers missed two prescribed left turns.

If "Yes," how is it accomplished; if "No," how could it best be accomplished?

Standard location of signs; larger legends.

Even here they are sometimes identified too late to make the desired turn. Mid-block advance signing in urban commercial areas is not desirable. Suggest larger signs at higher bottom height.

No comments.

Larger, sharper signs, more in advance--at least 1/3 block for ordinary streets; larger characteristic signs 1 block in advance of main intersection.

I suggest advance street-name signs mounted at about 12' - 16' high in light standards or other poles about ¼ block in advance (6" x 4" upper/lower case letter sizes are suggested).

It can only be accomplished by slowing down to 20 mph. An obvious correction would be large advance signs. The designated left turn lanes lose their effectiveness as now signed.

Question: Where lane assignments are indicated (i.e., a requirement of being in a certain lane to perform a certain maneuver) are the assignments clear and easily understood?

Yes	No	Comments
x		"This lane must turn left" or "right" was signed well, and pavement was marked.
x		Generally lane assignment involved a turning movement. Pavement markings and overhead signs were adequate for me.
	x	Not at all times.

Yes	No	Comments
x	x	Exit lane from Southfield Expressway was adequate. Once you are aware that turn around lanes are available, they seem fairly well marked. Center lanes for turning and rush hour traffic need signs with more viewer impact.
	x	There were very few such signs.
	x	

If "No," please indicate the source of the confusion.

Poor lane lines at times.

Into Telegraph from Grand River; Southfield into Grand River. Center lanes on Grand River.

On Grand River Ave. westbound, signing drivers to the north to go south seemed wrong to one as a stranger. The signs read "KEEP RIGHT." A more positive statement, such as "USE RIGHT LANE," would have been better.

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)?

Yes	No	Comments
x		This occurred to me and also to the driver I observed. Perhaps unfamiliarity caused it.
	x	Lane designations for prohibited left turns to be made beyond the intersection or to be made by a street turn and then a directional cross-over thru median may be confusing to a stranger.
	x	
x		Did not experience such a situation on my trial run, although I can recall other locations where I have been conscious of this.

Yes	No	Comments
x		Would have been simpler and shorter to have not turned North on U.S. 24 S.H. to go South on U.S. 24. I preferred to go across and make a U-turn which was possible.
	x	

Question: Are the turn lanes clearly identified and outlined?

Yes	No	Comments
x		I felt this was well done.
	x	Lane designations for prohibited left turns to be made beyond the intersection or to be made by a street U-turn and then a directional crossover thru median may be confusing to a stranger.
x		
x		The delineation of the turn lanes was adequate but could have been improved.
x	x	Yes, for marking except confusion in distinguishing from reversible lane. No, for signs.

If "Yes," how are they marked; if "No," how could they be marked?

With confirmation signs--large and strategically located and on pavement.

Yes, pavement markings and signs. No, additional sign after making right turn or a "diagrammatic sign."

Overhead signs and lane lines.

Use of edge lines and better dramatizing lines would have improved demarcation of turn lanes.

Advance signs; larger letters.

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

Yes	No	Comments
	x	One turn lane (left) and another Southfield Service Drive sign here which confused me in a left turn. I felt "trapped" and changed lanes which turned out to be unnecessary.
x		
	x	Too much information.
	x	Sign at McNichols into Southfield too small (and others like it). Some places have too many diverse signs. Southfield, Fenkell, Grand River--no sign at all.
	x	The directional signs were too small in most cases, and there were too few in advance. There were very few route shields to M39 and B.R. 96.
	x	None of pure street sign messages are large enough except possibly the speed limit signs. Some of the State Highway signs are adequate.

Question: Are the turn lanes long enough so as to eliminate the need for a substantial speed reduction in the through traffic lanes?

/ / Always / / On Occasion

/ / Usually / / Seldom

A	B	C	D	Comments
	x			Except for hidden street signs, the left turn storage lanes seemed adequate.
	x			Except for peak turning movements when backup at signal might force vehicles into thru lane.
		x		

A	B	C	D	Comments
		x		Locations do not always permit parking areas, street intersections in close order, or multiple intersections, the crossway conditions are better.
	x			
	x			

Question: Are the right-of-way control devices (i.e., "STOP" signs, "YIELD" signs and signals) located in positions where they are readily apparent to a reasonably alert driver? (Answers: Yes; Poss.--Possibly; PL--Poorly Located)

Yes	Poss.	PL	Comments
x			Well signed and visible both overhead and at eye level.
x			Overhead signals are supplemented by far right ground mounts.
x			
	x		This varies greatly. Some places well done; other places casual to poor. Sometimes lost in a mass of signs, both highway and commercial.
x			Most regulatory signs could be seen. A stop bar on the northbound frontage adjacent to M39 Freeway would have helped.
	x		

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

Yes	No	Comments
x		Several informative signs were over observed.
x		This is not too applicable on the study section.
x		

Yes	No	Comments
	x	In the limited experience we had found such cases. Perhaps in general this would have been modified.
	x	
x	x	Signals visible; turning instructions poor.

If "No," how could this best be accomplished?

Overhead signs centered over main lanes well in advance for fast (45 mph) traffic.

Advance signs are needed for some situations. The Grand River Ave. lane drop had plenty of signs but was poorly delineated.

Question: Where hazard warnings are provided, can they easily be associated with the hazard involved? (Answers: Yes; ISC--In Some Cases; No)

Yes	ISC	No	Comments
	x		I noted a hazard sign and little hazard or reason for reduction of speed.
x			Very few hazard warnings on study section.
	x		
	x		My experience at McNichols and Grand River was negative. Perhaps this was chargeable to distraction but, also, such warnings should tend to overcome distraction.
x			
x			

Question: Are warnings provided for hazards which are obvious and for which little, if any, warning is actually required? (Answers: Yes; IFC-- In a Few Cases; No)

Yes	IFC	No	Comments
		x	I saw none.

Yes	IFC	No	Comments
x			
	x		
		x	Did not notice any.
	x		
		x	

Question: In your opinion, is there a question as to which traffic stream a "STOP" sign, "YIELD" sign, or signal applies?

Yes	No	Comments
	x	
	x	
	x	
	x	At parking lot entrance into Grand River; (Short St. northbound) lane opposite has green background sign with diagonal arrow toward left indicating westbound entrance into westbound Grand River. Immediately adjoining, there is a different,separate, night painting "ONE WAY" arrow in black and white for eastbound lane.
	x	
	x	

Question: Did you, as a driver, have difficulty in seeing the traffic lights? (Answers: Yes; Some--Sometimes; No)

Yes	Some	No	Comments
	x		They seemed to be lost in a maze of buildings, commercial signs and store fronts.
		x	If I were too far into the intersection to see overhead, I could see the far-right ground-mount.
		x	

Yes	Some	No	Comments
		x	With one exception, previously noted, on Grand River around corner from McNichols.
	x		I had trouble seeing the lights in at least one location.
		x	

Question: Do commercial signs along the roadway make traffic signs or signals difficult to see?

Yes	No	Comments
x		Street names are hidden, as well as the ground-mount signal,until one very near the intersection (parking along curb also obstructs vision to intersection).
	x	
x		Most times not. A driver missed the sign for Telegraph on the right while going west on Grand River.
x		
x		Too successfully competitive in attracting attention.

Question: Do the curb radii at the intersections permit smooth turns from the right into the right lane of the cross street?

Yes	No	Comments
x		For most intersections.
x		
x		I experienced no difficulty.
		The turnarounds in the wide medians on U.S. 24 had short or nonexistent deceleration lanes in some cases (maybe not in the study areas).
	x	
		Exceptions, Telegraph Rd. and M39.

Question: Do the driveways create an uncomfortable feeling while driving this section?

Yes	No	Comments
	x	Not aware of them.
x		With parked cars, intersecting cars are hard to see.
x		Business traffic frequently emerges. Some driveways can be confused with cross street openings, as near Warwick on Grand River.
x		
	x	

Question: Do commercial trucks block the view of the roadway ahead to a noticeable degree?

Yes	No	Comments
x		Believe I missed a left turn because of a truck immediately in front of me.
x		At times.
x		At certain times and places more than others. Isolated instances.
		I didn't see too many trucks on this route.
x		To a great extent; also, blocked view of signs.

Question: Does there appear to be an excessive amount of official informational signing along this section of roadway?

Yes	No	Comments
	x	There was very little, if any, official informational signing.
x		Parking signs.
x		It all seems to serve specific needs, it even omits some. Perhaps some condensed panels (large and reflectorized with sharp contrast centered overhead would help).

Yes	No	Comments
		There were so many regulatory signs that the few added service signs seemed more objectionable.
x		This is a personal opinion and applies to most streets of this kind. I have observed across U.S.A. traffic engineers who should study the psychology of "DO" signs and "DON'T" signs with the view of eliminating the negative. Also, obvious conditions should be left unsigned, such as "DIVIDED HIGHWAY AHEAD."

Question: In my opinion, the roadside advertising competes with the official highway signing and signalization for the driver's attention to:

/ A / A Marked Degree

/ B / Some Degree

/ C / A Limited Degree

/ D / A Very Limited Degree, If At All

A	B	C	D	Comments
		x		
	x			
		x		On routes covered. At other places not in this test run, roadside advertising does have a dangerously competitive effect.
x				
x				

SUMMARY OF THE DIAGNOSTIC QUESTIONNAIRES

Study Site 13; Business Route 96, Grand River Ave.; Detroit, Michigan

NIGHT PHASE

Question: Are the turn lanes obvious to the reasonably alert driver so that a smooth, natural maneuver to the turn lane is possible?

Yes	No	Comments
x		Lanes well marked generally.
x		Pavement markings are used for turn lanes with some direction from roadside signs. The overhead left turn prohibition, reversible lane designation is not visible but is not needed at night.
x		Lane is marked with yellow lines so that no passing is done in this area.
	x	On the Southfield Expressway I found this adequate, as well as at Fenkell and Grand River and Telegraph. Other places were obscure.
x		
	x	Street signs and visible turn lanes are part of a reversible lane system which is used part of day (peak traffic).

Question: The existing lighting provides a view of the road which is:

/ A / About the same as daylight conditions

/ B / Somewhat less than daylight

/ C / Adequate to illuminate the through lanes and turn lanes, but the intersections are not as visible as they should be.

/ D / Inadequate for safe driving.

A	B	C	D	Comments
		x		Commercial lighting is distracting at times. Luminaires do not allow for U-turn movement or intersection location on Telegraph.

A	B	C	D	Comments
		x		With relatively uniform and close spacing of luminaires, intersections were not visible. Advertising signs also caused visibility problems.
		x		
			x	This varied. Some intersections were brilliant; some street sections were the same. However, not enough to make street names visible to me, not even the major throughfares. The need to look for certain streets which were hard to find caused me to make errors and take chances which could have caused an accident.
	x			There was more light than needed at the east side of the project. Adequate elsewhere.
		x		

Question: Does the glare from opposing headlight and/or the roadway lighting tend to obscure the driver's view of the roadway ahead? (Answers: Prob--Probably; Poss--Possible; NMD--Not to Any Marked Degree)

Prob	Poss	NMD	Comments
x			I noted opposing headlight and occasional street lighting glare. I feel more secure with less lighting.
		x	An occasional car's bright or misdirected lights were distracting.
		x	
x			This was more apparent when I was in the center lane searching for a street into which I was directed to turn left. Some varied harshness in opposing lights.
		x	
		x	Nearly all drivers use low beam headlights; nearly level, no approved number of alternate bright and dark conditions.

Question: Does the location of the roadway signs, with respect to the street light, make them difficult to read at a glance? (Answers: Yes; ISC--In Some Cases; No)

Yes	ISC	No	Comments
	x		Some were impossible; others were OK with light reflecting towards signs. Others were blocked by light poles.
x			I had great difficulty reading street name signs. Route markers (B.R. 96) were absolutely ineffective.
	x		At times they are lost in a maze of signs.
x			I had great difficulty. Some were located behind other signs or obstructions or out of the normal direction of driver's line of vision.
	x		
x			The signs needed to be read are overhead; right and left light cannot help, but fearful conditions may be due to sign location and size and not to lights.

Question: In your opinion, would varying the color of lights at the intersections assist in identifying them? (Answers: Yes; Poss--Possibly; No)

Yes	Poss	No	Comments
x			Interesting idea; certainly would give one a guideline to go by.
	x		This has been tried at some hazardous curves with minimum success.
	x		
x			Major streets are usually marked by control lights, but most other side streets were indistinguishable from driveways in the light available.
		x	
		x	

Question: Where directional signing is provided, can it be easily read and understood at a glance? (Answers: Yes; Poss--Possibly; Doubt--Doubtful; No)

Yes	Poss	Doubt	No	Comments
	x			When overhead, but some by the side of the road (Southfield Service Drive) were confusing. Left turn to Grand River is difficult.
		x		Some light reflection from overhead signs caused difficulty in reading.
		x		Most have too much information, and a driver is unable to read full sign at speed limit.
			x	Except on Southfield Expressway.
			x	
			x	In some cases the driver would mistake both the street and direction (example: westbound turn from Grand River to Telegraph). Probably local drivers would have no difficulty.

Question: Are the driving lanes clearly identified?

Yes	No	Comments
x		Except where parking is allowed, one finds himself in an extra wide lane (if no one is parking).
x		With very little, if any, curb parking this unmarked lane was available for thru traffic.
	x	Some lines are faint, and some just stop, with little or no warning.
	x	Exception on Expressway and Telegraph Road.
	x	Some of the lane lines needed repairing.
		A first or second time driver would have trouble distinguishing between reversible lane and turning lane. Signs are not visible at night.

Question: Does the glare from opposing headlights make it difficult to read the traffic signs? (Answers: Def--Definitely; TSD--To Some Degree; No)

Def	TSD	No	Comments
	x		
		x	For the most part appropriate signs are right hand roadside mount, and the direction of sight was away from opposing headlights.
		x	
	x		Depends on individual circumstances and strength of illumination at a given point.
		x	
	x		Not too serious because of low beam.

Question: Is there sufficient advance notification for the turn lanes?

Yes	No	Comments
	x	In several instances of the Southfield Expressway, there was no advance notification except within 100 feet.
	x	Right turn lanes are not as difficult to see, even with advance notification being somewhat inadequate, but left turns have no advance notice.
	x	Could be longer.
	x	
	x	
	x	None except for freeways and U.S. 24.

Question: Do the turn lanes tend to trap the driver (i.e., is there a tendency for a driver to become trapped in a turning lane)?

Yes	No	Comments
x		On the Southfield Expressway Service Drive and on Grand River at Fenkell, one can feel trapped in "must turn" lanes.

Yes	No	Comments
	x	There is an adequate number of lanes so a driver will not be in turn lane unless he desires to actually make the turn.
	x	
x		I was trapped at least four times.
x		There were a few trapped lanes that caught me, I believe.
x		Most drivers I interviewed would have been trapped in heavy traffic.

Question: Can the street name signs on major streets be easily read at a glance?

Yes	No	Comments
	x	Several instances--Grand River and McNichols sign was not observed until almost past intersection.
	x	Street lights, roadside signal mounts, and advertising distracted and even blotted out the street name signs for me.
	x	Not large enough, nor uniform.
	x	
	x	The street name signs were too small and poorly located.
		U.S. 24 and M39 only.

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

/ A / Adequate / C / Questionable

/ B / Inadequate / D / Critical

A	B	C	D	Comments
x				Some signals were located on poles but were supplemented by overhead signs. The lower signals were not visible from a distance.

A	B	C	D	Comments
		x		As previously stated, in B.R. 96 route markers and the street name signs do not show well.
x				
	x			
x				
	x			

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

Yes	No	Comments
x		
x		Very few hazard warnings in study section.
	x	Better road design could improve this.
x		
x		The lane drop warning sign did the job. The excessive number of miscellaneous signs made the important signs less effective.
x		Not completely applicable to this project.

Question: Do commercial signs and light along the street detract to a marked degree from the effectiveness of traffic control devices (signs, signals, etc.)? (Answers: Yes; Poss--Possibly; No)

Yes	Poss	No	Comments
x			Used car lots, church spot light, flashing lights, and general color arrangement make a detraction, as well as cause signal lights to blend in with commercial.
	x		The low string of bulbs at car lots were particularly distracting.
	x		Due to the size of some signs, this could be true.

Yes	Poss	No	Comments
	x		Varies with location and strength of both public and private illumination at a given point.
x			The many bright advertising signs in the middle of the project (on Grand River Avenue) bothered me.
x			In built up areas.

APPENDIX "C"

SUMMARY OF DRIVER INTERVIEWS

Study Site No. 13; Grand River Avenue; Detroit, Michigan

GEOMETRIC DESIGN

DAY PHASE

I don't believe the left lane is really as narrow as it appears to be. I think it just looks that way (this comment is made going westbound on the divided section near the west end).

I got the message about the lane drop because I could see it coming (this comment is made just after the transition from the divided four-lane to the undivided section going eastbound).

I would be more than a little apprehensive about driving in that left lane with the curb right up against the lane (the driver is apparently referring to the relatively narrow left lane and the comment is made near the intersection of Shiawassee on Grand River Ave. going westbound).

NIGHT PHASE

I get the feeling that the lane next to the parking lane is narrower than the middle lane but it might just be an illusion (this comment is made at Redford Ave. going eastbound at Grand River).

That right and then left turn maneuver just doesn't appeal to me at all. It might be more efficient but I think I would just go on up there and make a U-turn then a right turn. Any way you look at it, it is a lot of action just to make a left turn (the driver is referring to the left turn maneuver from Grand River Ave. going westbound onto Telegraph Rd. going southbound).

I think I drove that pretty objectively. I didn't see that sign ("TELEGRAPH ROAD KEEP RIGHT") in time to make the intended maneuver. So, I'll just keep going on down until I find some place to make a U-turn and come back. I felt confident I would find a place because this is a boulevard and there seemed to be numerous streets (this comment is made at the intersection of Grand River Ave. and Telegraph Rd. going westbound on Grand River).

I believe if I were going to make a left turn onto Telegraph, I would be in the left lane, perhaps not the far left lane because it looks pretty narrow (this comment is made on the divided section approximately ½ mile east of Telegraph Rd. going westbound).

DAY PHASE

NIGHT PHASE

Even if you go right on through this intersection and make the U-turn, you have to then cross about four lanes of traffic to make the right turn onto Telegraph Rd. It wouldn't seem very appealing to me, especially in heavy traffic (this comment is made on Grand River Ave. going westbound at Telegraph Road).

SIGNALIZATION

DAY PHASE

In regard to the placement of the signal heads, I much prefer the mounting over the lane or in the middle of the intersection. The ones that are mounted on the right are often obscured by trucks so I have a habit of looking for them in the center.

I was definitely not prepared to stop here. I think you distracted me a little with the conversation. (This driver is referring to the pedestrian signal just east of McNichols West on Grand River Ave.).

Even though there are two signal heads on the right, I like having the one on the left as well. It serves as a confirmatory signal if nothing else. (The driver is referring to the third head mounted on the far left at the intersection of McIntyre going westbound on Grand River Ave.).

NIGHT PHASE

The background lighting behind that pedestrian crossing signal made it impossible to see. I was just lucky I saw her legs and was able to stop. (This comment was made at the pedestrian crossing just east of the McNichols intersection with Grand River Ave.).

SIGNING

DAY PHASE

That River View street name sign should have been placed a little in advance of the actual intersection.

Now I know that this is Lahser because I remember it from the map. But I think it should have an advance marking of some type. I believe, my preference would be for an overhead with big enough letters to be read well in advance of the intersection.

I don't use those "MERGING TRAFFIC" signs when I drive on the freeway. I think I tend to depend on my individual observations (this comment is made on the Southfield Freeway approaching Grand River Ave. exit).

That abbreviation doesn't confuse me as I know what it means. In some cases, especially to strangers, they can be tricky though. (The driver is referring to the abbreviation on Grand River Ave. as "GR. RIVER AVE." on the Southfield Freeway approaching the Grand River Ave. - Fenkell interchange).

I believe there is a definite need for better signing here. Other than the signs on the freeway and the obscure little sign placed high on the post, there is nothing to indicate that this is Grand River or Business Route 96 (the driver is referring to the intersection of the west service road with Grand River Ave. and Fenkell Ave.).

NIGHT PHASE

These informational signs don't seem to stand out very well at night. I think there is something about parking (the driver is referring to the parking signs located on the right side throughout the study section).

I believe if I were unfamiliar with this maneuver, I would have gone straight on across it before I knew it (the driver is referring to the right turn from the southbound frontage road of Southfield Freeway onto Grand River Ave. westbound).

I really hadn't noticed those overhead signs but I think if I saw those signs and couldn't read them I would just assume that the middle lane was used for storage for left turns (this comment is made just west of the intersection of Outer Drive with Grand River Ave.).

I don't believe the street name signs are any easier to read at night. That one we just passed ("BOSWORTH") I couldn't even read it.

That one there (the driver is referring to the street name sign for Lahser St.) over the signal is completely blocked out as far as I am concerned. I believe this is because of the signal.

I had no indication that this was Outer Drive until it was to late and this is why I missed it. I think ordinarily if I were looking for it, in particular, I would look for a street say two blocks away and when I passed it, I would know Outer Drive was close.

DAY PHASE

I think these signs should either be cleaned more frequently or reflectorized so that they can be read more easily (the driver is referring to the span-wire mounted signs over the center lane to identify the reversible operation).

I believe that street name signs should be placed one-half block to the near side of the actual intersection, as well as at the intersection. I believe that "STOP" signs in the residential areas should have been much larger than they were (the driver is referring to the "STOP" sign at the intersection of Lancashire and Outer Drive).

The street name signs look to be a little small to me. I think they probably have three inch letters.

I don't believe I need that "MICHIGAN STATE POLICE" sign for information.

There seems to be quite a clutter of signs here at this lane drop. At this speed I couldn't begin to read them all (this comment is made at the transition from a divided section to the undivided section just west of McIntyre).

I agree with the observation about the clutter of signs, I did not make this observation when I was driving.

This overhead sign ahead looks like a pretty important sign but it should have about six inch letters instead of the three inch ones so that it could be more easily read (the driver is referring to the "LEFT TURN ONLY" sign over the reversible lane).

NIGHT PHASE

I don't believe you could ever find that one. It is mounted up by the street light and behind the post (the driver is referring to the street name sign for Trinity Ave. going westbound on Grand River Ave.).

Those overhead signs are totally useless at night. It should be noted, however, that they are not applicable at night, however, it is a source of concern to the driver when he can't read them. (The driver is referring to the span-wire mounted overhead signs indicating the reversible lane operation).

To me, these street name signs are a lot easier to read at night. I haven't had any trouble finding the signs although I still can't read them well. They have good target value but the readability leaves much to be desired.

I wonder if a diagrammatic sign for that intersection might not help at this point. I'm not sure what it will look like but I think it would be helpful (the driver is referring to the left turn maneuver onto Telegraph Rd. from Grand River Ave. going westbound).

I believe that this is an extraneous sign ("DIVIDED HIGHWAY ENDS"). I think they need one to tell you that there is a lane reduction and there is not one in place now. (The driver is referring to the transition from four lanes to three lanes just west of Telegraph Rd. on Grand River Ave.).

DAY PHASE

NIGHT PHASE

I really doubt whether these signs will show up at night. They are pretty old (the driver is referring to the span-wire mounted overhead signs for the reversible lane control).

We are crossing Travel Street and I didn't notice any advance signing and it looks like a pretty important street. I would prefer to have an advance warning sign a couple of hundred feet in advance of the intersection (the driver was actually at the intersection of McNichols Rd. and saw the street name sign for the minor intersecting roadway at Chapel).

Regardless of the message, I think all signs should be white on black, or white on green, but not mixed.

The sign "CAUTION COACHES TURN" is absolutely meaningless to me (this comment is made at Plainview Street going eastbound on Grand River Ave.).

The way these business route signs are scattered through here is real good. I think a tourist would find these extremely helpful.

There ought to be a law against this. There is no signing whatsoever to tell me that this is the way to State Highway 39 or to the Southfield Freeway and for that matter to anything else. (This comment is made on Grand River Ave. approaching the Southfield Freeway going eastbound).

If you look at that exit to Grand River and Fenkell, when you get to this intersection you just have to guess which one this was (the driver is on the east frontage road going northbound approaching the intersection of Grand River Ave. and shortly beyond that Fenkell Ave.).

DAY PHASE

NIGHT PHASE

I believe that there is an excess of "NO PARKING" signs along this section. (This comment is made at approximately Avon Ave. going westbound on Grand River Ave.).

I can't imagine what type of signing would help at this intersection (the driver is referring to the left turn maneuver onto Telegraph Rd. southbound from Grand River Ave. going westbound). If anything would help, I think it would have been an overhead sign over the right lane saying "U.S. 24 NORTH AND SOUTH" with a down arrow.

I believe that that sign (sign indicating the route to the tunnel to Canada) would be useful but probably only to a relatively small percentage of the drivers.

I think normally I like to look to the right on the far side of the intersection to find street name signs. It seem to me that they have abbreviated the wrong word in that sign message. Rather than GD. RIVER AVE.", I think I would have put "GRAND RIVER AVE." or something similar.

You know the only indication I had as to what street this was, was the exit sign from the freeway (the driver is on the west frontage road going southbound approaching Grand River Ave. - Fenkell Ave. intersection).

I believe as a general rule, I would rather not have many informational signs at the intersection proper. I believe this would conflict or interfere with the driver's attention to the pedestrian traffic.

DAY PHASE

NIGHT PHASE

I like the whole idea of trail blazers and I use them. I think almost every one else does also. But I think it is imperative to have cardinal directions on them.

I believe enough people use that sign ("MICHIGAN STATE POLICE") to make it worth while.

Even though I knew where Lahser was, I found the signing very inadequate. So much concentration must be centered on the intersections and just driving that you don't have time to search for the street name signs. I think I would recommend putting advance signs on at least the major streets if not all of them.

There seems to be a lot of extraneous parking signs in this section. That sign ("NO STANDING") just looks weird to me. It seems like they could find more appropriate wording.

It might be well advised to have an overhead sign a few hundred feet in advance in order to enable the driver to position himself a little better for this maneuver (the driver is referring to the approach to the Grand River Ave. - Fenkell intersection from Southfield Freeway going southbound).

ILLUMINATION

DAY PHASE

NIGHT PHASE

Of course it is daytime and these are an older design for luminaires but it seems to me that they are excessive.

I am getting some glare reflections from the used car lot. I noticed it particularly at the intersection of Grand River and Grayfield.

DAY PHASE

NIGHT PHASE

When I get right underneath these lights I do get quite a bit of glare. They look like the old fashion lights.

I noticed a distinctive difference in illumination along here. I'm not sure just what it is but there is a difference (this comment is made on Lahser just south of Grand River Ave.).

As far as I can tell the street lights have very little effect on the illumination. Of course, it is quite shaded along here, (the comment is made just after the left turn onto Grand River Ave. from Telegraph Rd.).

Now it is considerably better along here. The absence of trees and the fact that there are luminaires on both sides of the street, considerably improve the illumination. (This comment is made just prior to the intersection with Northrop).

These row-type lights on the used car lot bother me a heck of a lot more than the flashing ones (this comment is made just east of Evergreen St. going westbound on Grand River Ave.). However, I believe that it would be more trouble than it is worth to try and keep them from doing it.

These are the kinds of light that really bother me (the driver is referring to the row-type incandescent lights at the used car lot just west of Grayfield).

I am picking up quite a bit of glare from these luminaires. It isn't severe but it is still there (this comment is made between Trinity St. and Lahser St. going westbound on Grand River Ave.).

PAVEMENT MARKINGS

DAY PHASE

The pavement markings are very dim here and the situation is accentuated by the light pavement (this comment is made at Codding Ave. going eastbound on Grand River Ave.).

The pavement markings are very weak here. I can just barely make them out (this comment is made just east of Shiawassee going eastbound on Grand River Ave.).

NIGHT PHASE

It is probably due to the fact that it is dark plus the fact that the markings are dim, but I can't really see the lane lines here (this comment is made just east of Telegraph Rd. on Grand River Ave. going eastbound).

MISCELLANEOUS COMMENTS

Traffic pulling out from adjacent property just can't help but be disconcerting, although it is not a critical problem (this comment is made between Trinity St. and Evergreen St. going eastbound on Grand River Ave.).

Seems to me that something could be done about the intensity of the illumination of the advertising especially along here (the driver is referring to the use of incandescent lights in a long row in order to attract attention to the used car lot).

I think if anything this section is more comfortable at night than in the daytime; I certainly don't have any trouble at night.

I guess the reason I turned there was because I was thinking Outer Drive was the next signal and I didn't see a sign indicating it was Evergreen.