

**UC Berkeley**  
**IURD Working Paper Series**

**Title**

ENVIRONMENTAL QUALITY OF CITY STREETS

**Permalink**

<https://escholarship.org/uc/item/8zp7m787>

**Authors**

Appleyard, Donald

Lintell, Mark

**Publication Date**

1970-12-01

**Working Paper 142**

**Environmental Quality  
Of City Streets**

**Donald Appleyard  
and  
Mark Lintell**

**December 1970**

**University of California at Berkeley  
\$4.50**

---

**Working Paper 142**

Environmental Quality  
Of  
City Streets

Donald Appleyard and  
Mark Lintell

University of California at Berkeley  
Institute of Urban and Regional Development

---

ENVIRONMENTAL QUALITY OF CITY STREETS

by

Donald Appleyard  
Mark Lintell

December 1970

Working Paper No. 142

## ENVIRONMENTAL QUALITY OF CITY STREETS

Donald Appleyard  
Professor of Urban Design  
Departments of City and Regional Planning and  
Landscape Architecture  
University of California, Berkeley

Mark Lintell  
Graduate Student in Urban Design  
Department of City and Regional Planning  
University of California, Berkeley

Protests and research about the environmental and social impact of transportation systems have paid most attention to the problems created by new freeways through urban areas. But while these are the more dramatic instances of traffic impacts, traffic on city streets may affect as many, if not more, people. In San Francisco, according to a recent count, approximately 60 percent of the city's major streets (over 10,000 daily traffic volume) were lined with residences.

Studies of urban streets have concentrated almost exclusively on increasing their traffic capacity, through devices such as street-widening, signalization, and one-way streets, with no parallel accounting of the

environmental and social costs of these alternatives. Wilfred Owen (1969) recently directed attention to the role that city streets play in the environmental quality of cities, as 'the main corridors and front parlors' of the city, but even he did not point out that people also have to live along city streets.

To our knowledge, the only empirical studies of life on city streets apart from some studies of traffic noise have been those carried out in Britain in connection with the Buchanan Report, Traffic in Towns (H.M.S.O. 1963) -- the report which had a profound impact on British transportation and urban planning in the following years, particularly through its proposal for the creation of 'environmental areas' of controlled traffic capacity of new and existing cities.

The investigation reported here is a small-scale attempt to identify the environmental concerns of those who live on city streets in San Francisco.<sup>1</sup> It is a pilot study using observation and open response interview techniques, not pretending to statistical significance. The results however are suggestive. The project grew out of the San Francisco City Planning Department's concern over the increasing traffic on the city's streets and the side effects of street widenings and other proposed changes in the street system. It was one of a series of studies of environmental conditions made in San Francisco during 1969 and 1970. (San Francisco City Planning Department, 1970.)

---

<sup>1</sup>We are indebted to the staff of the San Francisco Department of City Planning for supporting this project through an urban planning grant from the U.S. Department of Housing and Urban Development, under the provisions of Sec. 701 of the Housing Act of 1954 as part of their Urban Design Study. Elizabeth Seltzer did the drawings.

### Study Streets

Of the street blocks selected for a general study of street living the results from three streets only will be reported here to serve as a model of the research approach and since they contrast the effects of traffic on similar types of streets. The street blocks chosen were adjacent north-south streets of similar residential character in the northern part of the city.

### Traffic

The major environmental differences between the streets were their traffic levels. The first street, which we shall call HEAVY STREET, was a one-way street with synchronized stop lights with a peak hour traffic volume (at the evening rush hour) of 900 vehicles per hour. The second street, MODERATE STREET, was a two-way street with a peak traffic flow of 550 vehicles per hour, the third street, LIGHT STREET, had a volume of only 200 vehicles at peak hour.

Speeds on all streets could rise to 45 mph or more but only on HEAVY STREET was the speed controlled by the synchronized lights. Traffic volumes had increased on HEAVY and MODERATE STREETS ten years earlier when they were connected to a freeway at their southern terminal. Through traffic was dominant on MODERATE and HEAVY Streets, and traffic composition included more trucks and buses on HEAVY STREET than on the others.

### Population

The three study blocks were part of a residual Italian neighborhood with other white Americans and a small but growing Oriental minority.

TABLE 1:

<u>Street Characteristics:</u>	HEAVY STREET	MODERATE STREET	LIGHT STREET
Peak hour traffic flow (vehicles/hour)	900	550	200
Average daily traffic flow (vehicles)	15,750	8,700	2,000
Traffic Flow direction.	one-way	two-way	two-way
Vehicle speed range (m.p.h.)	30-50	10-45	10-35
Noise levels (percentage of time above 65 decibels at the sidewalk.	45%	25%	5%
Accidents (per annum over a four block length).	17	12	-
<u>Land Uses:</u>	Residential (apartment blocks, apartments)	Residential (apartment blocks, apartments, single fam- ily homes) Corner Store	Residential (apartments, single fam- ily homes) One Man Business
Street width (feet)	69	69	69
Pavement width (feet)	52	41	39
Sidewalk width (feet)	8.5	14	15
Average building height (no.of storeys)	3.5	3.0	2.5
Interview Sample:			
Mean household size (no. of people)	1.5	2.6	2.7
Mean household income (\$1,000's)	6.6	8.1	10.0
Mean number of school years completed	14	13	15
Mean length of residence	8.0	9.2	16.3
Mean rents (\$ per month)	140.00	120.00	103.00



By social class and income the streets were relatively homogenous. Contrasts, however, occurred in family composition, ownership, and length of residence.

LIGHT STREET was predominantly a family street with many children. Grown-up children are even returning to live on the street to bring up their own children there. One-half of the people interviewed were homeowners, and the average length of residence was 16.3 years. HEAVY STREET, at the other extreme, had almost no children on its block. It was inhabited mostly by single persons of all ages from 20 years upward, with many old people, especially single elderly women on the block. Average length of residence on HEAVY STREET was 8.0 years, and people were nearly all renters. Rents were also somewhat higher on HEAVY STREET, averaging \$140.00 among our respondents, whereas those on LIGHT STREET, average residence 16.3, averaged \$103.00 a month. MODERATE STREET stood in between. Average length of residence here was 9.2 years and average rents were \$120.00. So, although the people were of the same type on all three streets, there was quite a difference in their age and family make-up.

#### Environment

The three streets were typical San Francisco streets with terrace houses or apartments built up to the building-line, very few front yards and very few gaps between the houses. The architectural style ranged from Victorian to modern. They were either wooden, stucco or brick finish, of white or light colors. They were pleasant-looking blocks. The streets were each fairly level, with a slight gradient to the south where they ran up a steep hill. They were close to various shopping and community facilities.

### Study Design

The method of study drew on two sources of information. First, a detailed interview lasting about an hour and taken with twelve residents on each block, composed of three equal age categories, the young (under 25) the middle-aged (25-55), and the elderly (over 55). This was not a very large sample but since they represented about 30 percent of the households on each block, their attitudes were probably representative of those on the three blocks. Second, we made systematic observations and, where possible, objective measurements of pedestrian and traffic activity on the streets.

The study design stemmed from earlier papers by Appleyard and others (Appleyard and Lynch, 1967, Appleyard and Okamoto, 1968) which proposed environmental criteria to be used in transportation system design. The criteria identified in the earlier studies were hypothetical in nature and for this investigation were slightly modified to cover the probable concerns of those living on urban streets.

In trying to reach an overall assessment of the environmental quality on each of the three blocks we divided our task into five criteria categories to describe the character and day to day use of the street as well as the concerns and satisfactions of the residents. The residents were not told that we were primarily interested in the effects of traffic; the interview was introduced as a survey of what it was like to live on the street and a means of finding out what the resident thought of his street and any suggestions that he might have for its improvement.

The criteria categories were:

**Traffic Hazard:** concerns for safety associated with traffic activity.

**Stress, Noise and Pollution:** from noise, vibration, fumes, dust, and feelings of anxiety concerning traffic.

**Privacy and Home Territory:** the residents' responses to intrusion from outside their homes, and the sense that the part of street itself was an extension of their personal territory or turf.

**Neighboring and Visiting:** the degree to which residents had friends and acquaintances on the block, and the degree to which the street was a community.

**Identity and Interest:** the degree to which the respondents of the three age groups were aware of their surroundings and the strength of each street's identity and were concerned for the external appearance of the buildings and the street as well as the degree to which the residents of the street felt that they were able to make adjustments and alterations to the street environment through planting, construction and other means.

Each question in the interview was related to one of the above categories, though some answers had relevance to more than one. The answers were rated by the interviewers on a five-point scale as 'environmental quality' ratings. Individual ratings were then aggregated by street for each question. No attempt was made to weight the responses in terms of their overall importance although this report emphasizes the main points of concern for the residents as expressed in the interviews. But ratings are rather abstract interpretations of the way people feel, so in the following pages we shall explore more deeply their responses to each

set of qualities. To make these findings more understandable to the public readership of this report, we graphed the responses in cartoon form and quoted extensively from the interviews at the beginning of each section. We display these as examples of how to communicate research of this nature to the public. So far the report has met with considerable response in San Francisco.

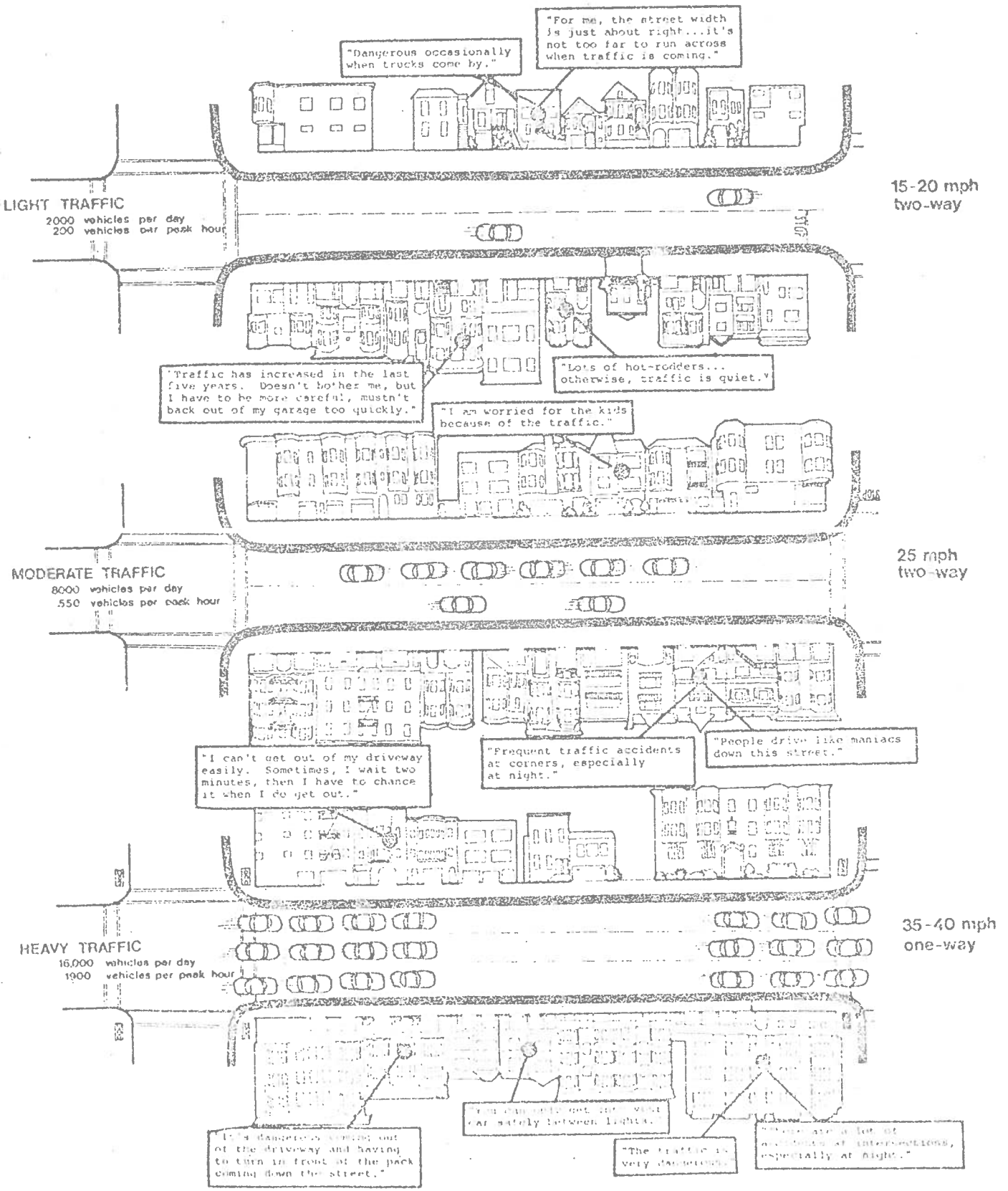
TRAFFIC HAZARD (Figure 1, Table 2)

Quotes:

"The traffic is very dangerous -- Traffic accidents are frequent at both intersections, especially at rush hours -- Traffic is fast, the signals are set fast -- Traffic is heavy and fast, the fastest in the neighborhood -- It's dangerous for children because of traffic. You can't wash your car on the street for fear of being knocked down and if water is sprayed on passing cars, they get very angry -- I think it is a highly accident-prone area, I often hear screeching brakes -- As a resident, I would prefer the traffic speed to be a little bit slower -- This street is murder; I like European streets better." (HEAVY STREET)

"Our street has become a freeway -- It's a busy street, I don't trust the children on the sidewalk -- Hear brakes screeching at corners at night -- It's difficult backing out of the garage because of traffic -- I am worried for the kids because of traffic -- Accidents and near-accidents frequently at (intersection) -- Sometimes dangerous with commuter traffic between 5-6:00, especially round grocery on corner -- There's something deadly about the street." (MODERATE STREET)

STREET LIVABILITY STUDY: A SURVEY OF HOW RESIDENTS VIEW THEIR STREETS



TRAFFIC HAZARD

TABLE 2: Mean Ratings of Traffic Hazard

Rating: 1 = very safe, 5 = very unsafe

	HEAVY	MODERATE	LIGHT
What is traffic like on this street, how would you describe it? Does it bother you at all?	3.7	3.2	2.2
Is it ever dangerous on your street and around your home? (traffic accidents, incidents, etc.)	3.8	3.0	2.5

"Sidewalks are fine; kids can play, prams or buggies get round cars very comfortably -- Children have to be taught care in crossing the street -- Traffic is getting worse." (LIGHT STREET)

\* \* \*

Accident counts were equally high on HIGH and MODERATE STREETS, (an average of 17 & 12 accidents per year over a four block length).

The danger of traffic was of concern to inhabitants on all three streets, but especially so on HEAVY STREET (ratings 3.7, 3.8). These findings are not surprising, since "safe intersections" was the most repeated concern in the recent city-wide surveys of street inhabitants.

HEAVY STREET is a one-way street with synchronized stoplights, which enable bunches of vehicles, already with momentum from travelling downhill, to travel through at speeds of up to 45 m.p.h. The fast speeds were frequently mentioned in the responses. The very heavy traffic volumes on HEAVY STREET also obviously made it unsafe for children, and even for people washing their cars. But for residents trying to manoeuvre out of their garages, a one-way street has its advantages over a two-way street, since the driver only has to look one way. Getting a car into a garage can be more difficult as the driver either has to swing across the traffic flow or pull to one side and wait for a lull. Most of the safety problems associated with traffic, especially on HEAVY STREET, were experienced indirectly either by seeing a large number of cars speeding down the hill and waiting for someone to make a false move. Several residents felt that the speed limit on HEAVY STREET should be reduced.



At the other extreme, LIGHT STREET, which only has a small amount of through traffic, has problems of a different nature. Because the street was relatively empty of traffic, it tended to attract the occasional hot-rodder who was, in some instances, a greater menace than the steady stream of traffic on HEAVY STREET. He appeared without warning, often jumping the stop signs at intersections, and was extremely dangerous for children playing in the street. The hot-rodder was found to be a problem on many otherwise quiet residential streets in the city. Another problem on a street which seldom requires precise traffic control was the temptation to park where it was immediately convenient. On LIGHT STREET, delivery trucks often parked on the corner when making deliveries to the grocery and blocked the view down the cross street for motorists approaching the intersection.

The situation in the minds of those on MODERATE STREET lay somewhere between the two extremes, at some periods during the day tending towards one and at other times towards the other. However, as one respondent put it, "there have been some accidents and I am taking precautions."

Apart from the direct effects of traffic on the feelings of safety, there were some indirect effects. The continuous presence of strangers on HEAVY STREET, even though they were in automobiles, evinced some feelings of fear. One young housewife had frequently been hassled from passing cars, and some of the older ladies on HEAVY STREET were "afraid to stop and chat."

As can be seen from the aggregated ratings, there was a consistent trend through all age groups to consider LIGHT as being safe, MODERATE as being neither safe nor unsafe, and HEAVY as being unsafe.



STRESS, NOISE, AND POLLUTION (Figure 2, Table 3)

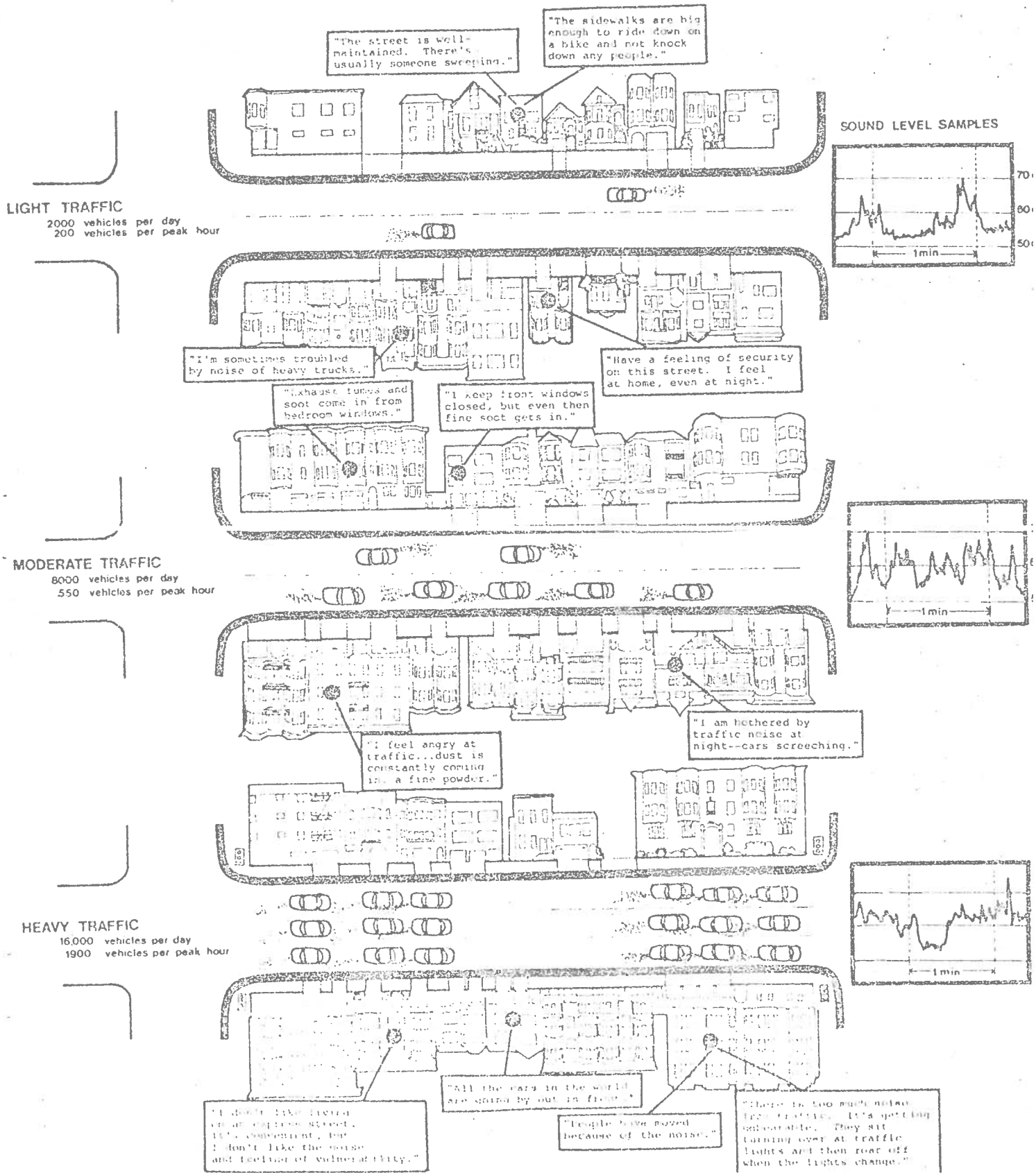
## Quotes:

"Traffic noise bothers me, mostly during the day, but it's heavy at night, also -- I am bothered by the exhaust from traffic and noise. Lately the trucks have been returning to this street, even though they are banned -- Troubled by traffic noise, mostly trucks and motorbikes. The street acts like an echo chamber, especially for sirens. It continues day and night -- Bothered by noise and vibration - I have to straighten pictures frequently -- There is too much noise, from traffic, it's getting unbearable. They sit ticking over at traffic lights then roar off when lights change -- Traffic coming from freeway, empty muni buses, school buses, and greyhound buses, they come in herds. Huge trucks as well. This goes on day and night. Army Presidio buses make more noise than anything else -- People have moved because of the noise -- Noise is terrible from traffic. I can feel vibration even up on the fourth floor, especially from buses -- Have to take a nap during the day as don't get enough sleep at night because of the traffic -- The street is well maintained by old ladies washing down front steps once a week -- Other than traffic, it has a very nice appearance -- It's absolutely disgusting the amount of litter there is -- It's terribly dirty and often have traffic fumes. I sometimes leave only the rear window open."

## (HEAVY STREET)

"The car gets dirty because it is parked on the street -- Smells from big trucks, not very often - Bothered by vibration from trucks sometimes, and by noise of hot-rodders revving up -- Feel helpless as far as traffic is concerned, I can never finish cleaning -- It's a dirty

STREET LIVABILITY STUDY: A SURVEY OF HOW RESIDENTS VIEW THEIR STREETS



NOISE, STRESS AND POLLUTION

TABLE 3: Mean Ratings of Stress, Noise, and Pollution

Rating: 1 = low stress, 5 = high stress

	HEAVY	MODERATE	LIGHT
Is there anything that bothers you or causes you nuisance on and around this street?	4.5	3.3	2.6
Are you ever troubled by noise and/or vibration?	3.7	2.5	2.4
Are you bothered at all by dirt, pollution, smells, glare? Does it to your knowledge cause any ill health?	3.4	2.9	2.0
Is there adequate street lighting?	1.4	2.0	2.4
Is the street too wide or too narrow?	2.1	1.9	1.7
Are the sidewalks too wide or too narrow?	2.5	1.8	1.3
Do you have adequate local services; garbage collection, street clean?	2.2	2.1	2.1
What physical qualities of the street do you like most? What physical qualities of the street do you find least attractive?	2.7	3.0	1.7
Is your street well maintained, are front yards, planting, sidewalks, etc., well kept up?	1.5	1.8	1.9

street, I have to be a janitor and sweep the street. People in cars dump cigar ash and beer cans in the gutter -- It's getting worse because of traffic; getting dirtier. The rot has set in -- Feel angry at traffic, dust constantly coming in, a fine powder." (MODERATE STREET)

"Sometimes bothered by noise of the occasional big truck which will wake the baby -- Motorbikes occasionally make a noise -- At night sounds of hot-rodders frequently -- Street well maintained. Usually someone sweeping, my mother or people next door -- It's getting better in that people are taking care of their property, painting it, etc., but worse in that there is more traffic and more cars -- A very relaxed family neighborhood, perfect. It makes me very happy -- It's improved, different interests displayed, trees planted across the street. More money spent on maintenance. -- Feels street is overcrowded, too many parked cars -- There are parking conflicts, parking is a pain because outside people put their cars in the driveways." (LIGHT STREET)

\* \* \*

#### TRAFFIC NOISE MEASUREMENTS (See Figure 2)

Actual measurements of noise levels were made on all three streets. The sound levels were determined through the use of Sound Survey Meters, utilized at four periods during a weekday; early morning (6:30 - 8:30 a.m.), late morning (11:00 a.m. - 12:30 p.m.), late afternoon (5:00 - 6:00 p.m.), and early evening (7:00 - 8:00 p.m.). In each measurement period, 50 consecutive measurements were made at 15 second intervals at corner and mid-block locations on each street. To translate these measurements into a useful measure of average conditions, the percentages of time that the noise exceeded certain A-weighted decibel levels [dB(A)]

were calculated. From these we computed a Traffic Noise Index,<sup>2</sup> a recognized measure of noise problems, which can be used to predict probable dissatisfaction due to noise. (Griffiths and Langdon, 1967).

On HEAVY STREET, noise levels were above 65 decibels for 45 percent of the time and did not fall below 55 decibels more than 10 percent of the time except in the early morning. These noise levels are so high that the Traffic Noise Index reads right off the scale. The two-minute sound level recording in Figure 3 illustrates that the character of noise on the street was uneven due to the waves of cars that flowed down the street, and to the occasional noisy vehicle which exceeded 70 decibels.

On MODERATE STREET, sound levels were above 65 decibels for 25 percent of the time. By the Traffic Noise Index, it would be rated (6.5) as "definitely unsatisfactory." On LIGHT STREET, the quietest of the three, sound levels rose above 65 decibels only 5 percent of the time, which on the Traffic Noise Index means that one half the residents would consider it "unsatisfactory" and one half "satisfactory." The two-minute sample sound level recordings on MODERATE STREET show that the noise levels tended to be more variable than on HEAVY STREET, but in the same range, whereas the sound level chart on LIGHT STREET shows an ambient noise level much lower than the other two streets.

After the danger of traffic itself, traffic noise, vibrations, fumes, soot and trash were considered to be the most stressful aspects of the environment on these three streets. Response ratings to the

---

2

It should be noted however that we did not take the customary hourly samplings over the full 24-hour period.

first general question were strongly negative on HEAVY STREET (4.5) and negative on MODERATE STREET (3.3).

On HEAVY STREET, the noise was so severe that one elderly couple was forced to try to catch up on sleep in the daytime. Many, especially the older people, were unable to be objective about the other characteristics of their street, since these stresses appeared to color totally their perceptions of their environment. Adjectives such as "unbearable," or "too much" or "vulnerable" were typical of the responses.

As with traffic hazard, the large mass of vehicles was not always the major problem. It was often the lone individual or the minority use that disturbed the situation. This was certainly true of HEAVY STREET where the large majority of cars were reasonably quiet and pass at a smooth even flow. The real offenders were sports cars, Volkswagens, buses, and trucks. The steady drone of traffic was certainly bad, but the random deep-throated roar of a bus or large truck, with the accompanying shudder that rattled every window, unnerved the most hardened resident, especially when it continued day and night. The screeching of brakes at the intersections added to their distress.

Residents on HEAVY STREET petitioned for a sign prohibiting trucks and buses. The sign was installed, but omitted to mention buses. It was small and the same color as the background, so it was not often seen. In any case, the law was not enforced, so truck drivers had learned that they may continued on their way with impunity. Such noise problems were not so acute on MODERATE STREET, where people were more bothered by the fumes, dust and soot which penetrated into their living rooms and bedrooms. LIGHT STREET had a few complaints of occasional noise.

## OTHER FORMS OF POLLUTION

The condition and cleanliness of the buildings on the three streets was generally high. Maintenance and clean appearance were clearly important to all the inhabitants. HEAVY STREET was constantly on show to outsiders who were travelling through it, and the owners of the buildings were careful to maintain a high standard of cleanliness despite the "disgusting amount of litter." The appearance of a quality environment was therefore maintained -- and paid for through higher rents -- but since the street did not encourage people to be outgoing, tenants were reluctant to accept responsibility for the street itself, so they avoided picking up trash and were slow to defend the street against vandalism and abuse.

On MODERATE STREET, concerns for trash, dust and soot where specifically referred to were more pronounced than on HEAVY STREET. This street was at that moment going through a difficult stage. Traffic and traffic problems were increasing, and yet there was no clear demarcation of responsibilities between public territory which was the responsibility of the city, and local territory which might have been the responsibility of the residents. People in parked cars had been observed dumping the contents of ash trays and beer cans into the gutter. Even so, it was still seen as a "good respectable place to live" and sidewalk maintenance by the local inhabitants had helped to keep up the appearance of the street.

LIGHT STREET was very seldom seen by outsiders and so the issue of maintenance was a local matter. This street was also seen to be changing and residents had noticed signs of deterioration. As one resident put



it, "the quality of [LIGHT STREET] is getting better in that people take great care of their properties, but worse in that there is more traffic and more cars on the street." Indeed, the responses showed that many inhabitants took an interest in looking after the cleanliness of the street and some had planted their own trees.

The only other inconvenience mentioned was the crowdedness of parking conditions. Many suburban commuters and users of the nearby shopping center were parking on these streets, and taking up parking spaces of the residents. In response to questions concerning the adequacy of street lighting, garbage collection, climate and convenience, the streets were considered to be without serious problems.

In reaction to all these issues, each age group found HEAVY STREET more severe, and the old and middle-aged groups found MODERATE STREET worse than LIGHT STREET. The only exceptions were the under twenty-fives who were more critical of LIGHT STREET. People on LIGHT STREET tended in many cases to be more aware and more critical of their street, while those on MODERATE were more apathetic.

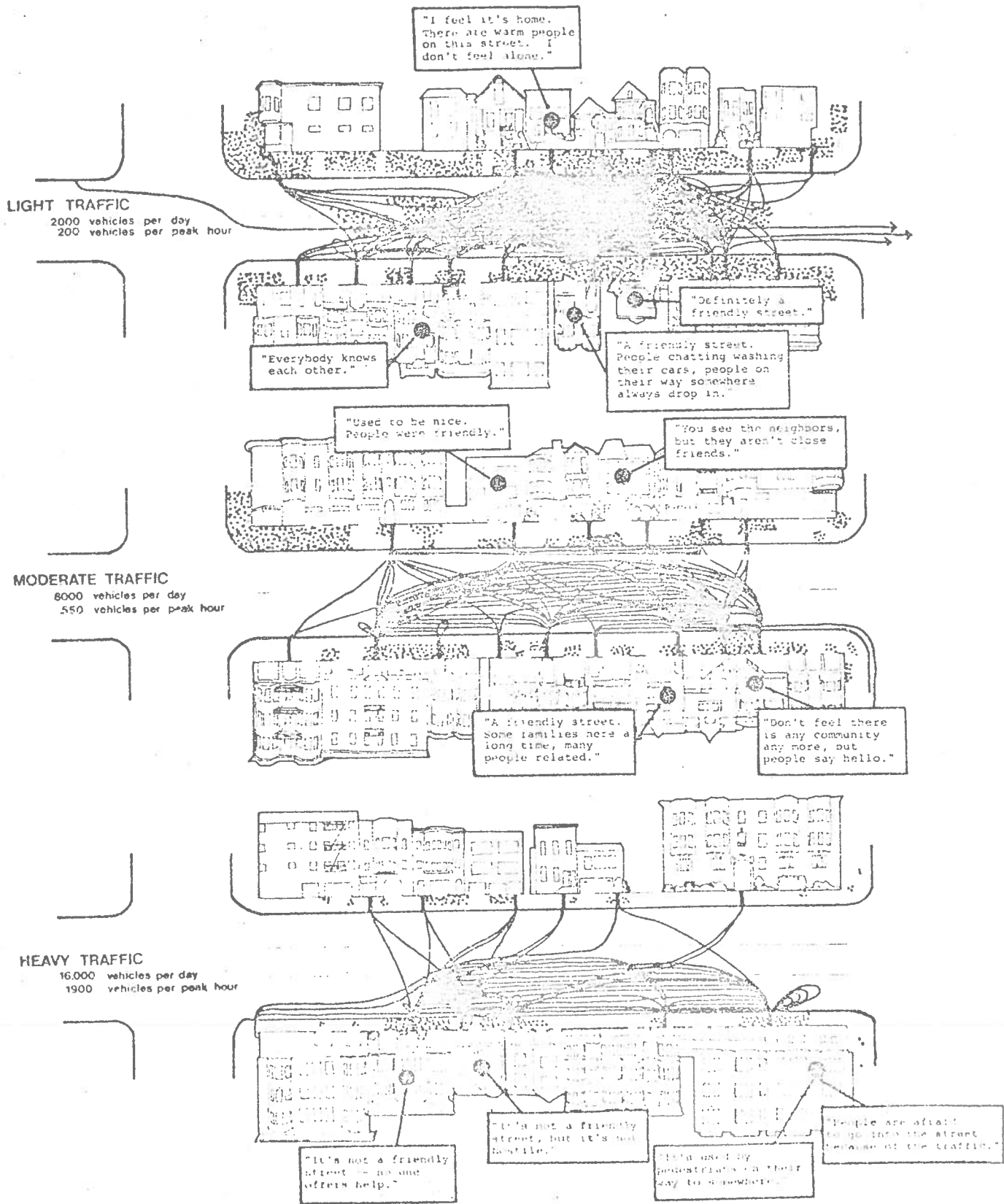
#### NEIGHBORING AND VISITING (Figure 3, Table 4)

##### Quotes:

"It's getting worse. There are very few children, even less than before -- The only people I have noticed on the street are an older couple in this building who stand outside every night, otherwise there are only people walking on their way somewhere -- It's not a friendly street, no one offers help -- Everybody on (HEAVY) is going somewhere else, not in this neighborhood -- Friendly neighbors, we talk over garden



STREET LIVABILITY STUDY: A SURVEY OF HOW RESIDENTS VIEW THEIR STREETS



NEIGHBORING AND VISITING

LINE'S SHOW WHERE PEOPLE SAID THEY HAD FRIENDS OR ACQUAINTANCES

DATA FROM INTERVIEW BEING USE CASE TO GATHER

TABLE 4: Mean Ratings of Neighboring and Visiting

Rating: 1 = high, 5 = low

	HEAVY	MODERATE	LIGHT
Do you think this is a friendly street?	3.2	2.0	2.0
Do you think there is a feeling of community on this street?			
Where do people congregate on the street if at all?	4.4	3.2	1.4
Where do children play if at all?	4.5	3.0	1.7
Where do teenagers gather if at all?	4.7	4.1	3.0
Where do adults casually meet and chat outside if at all?	4.1	2.5	2.7
Do you have any friends and relatives who live on this street?	4.2	3.2	2.8
Which people on this street do you know by sight?	3.5	2.8	1.8
Do you belong to any social organization or any form of local group?	3.6	3.4	2.5

fences -- It's not a friendly street as people are afraid to go into the street because of the traffic." (HEAVY STREET)

"Friendly street, many people related -- Friendly street, several families have lived here a long time -- There are no longer any of my friends around here any more - dislike most about street. I don't know neighbors any more. I feel helpless not knowing anyone in case of emergency -- Doesn't feel that there is any community any more. However, many say hello -- There's nobody around." (MODERATE STREET)

"Friendly street, people chatting washing cars, people on their way somewhere always drop in -- The corner grocery is the social center. I get a kick to go up there and spend an hour talking -- I feel its home, there are warm people on the street, don't feel alone -- All family people, very friendly -- Kids used to play in the street all the time, but now with a car every two minutes, they have to go to the park -- Everybody knows each other." (LIGHT STREET)

\* \* \*

A series of questions asked inhabitants about the friendliness of the street, the numbers of friends and acquaintances they possessed, and the places where people met (Ellis, 1968). Each respondent was shown a photograph of the buildings on the street and asked to point out where any friends, relatives and acquaintances lived.

On LIGHT STREET, inhabitants were found to have three times as many local friends and twice as many acquaintances as those on HEAVY STREET. The diagrammatic network of social contacts in Figure 3 shows clearly that contact across the street was very much more rare on HEAVY STREET than on LIGHT STREET. The friendliness of LIGHT STREET was no doubt

related to the small amount of traffic, but also to the larger number of children on the street and the longer length of residence of the inhabitants. The statements of the inhabitants corroborate this. They considered it "definitely a friendly street."

On HEAVY STREET, there was very little social interaction. With few if any friends (0.9 per respondent) the residents considered it not a friendly street. While it might be argued that this was primarily a consequence of the life style of those living on HEAVY STREET (Keller 1969), the sense of loneliness came out very clearly especially in the responses of the elderly. As for MODERATE STREET, there was a feeling that the old community was on the point of extinction. "It used to be friendly; what was outside has now withdrawn into the buildings. People are preoccupied with their own lives." Some of the families had been there a long time, but these were diminishing. As other respondents put it, "it is a half-way from here to there," "an in-between street with no real sense of community." There was still a core of original Italian residents lamenting that "there are no longer any friends around here." The average number of friends and acquaintances per respondent was only a little higher than on HEAVY STREET.

There were sharp differences between age groups. The middle-age group on the three streets possessed a similar number of friends, although those on LIGHT STREET had more acquaintances. They were probably more mobile and better equipped to make friends than the other groups. The young and old age groups, on the other hand, who had many less social contacts on HEAVY STREET than on LIGHT appeared to be more affected by the amount of traffic.

From the notations of street activities drawn by the subjects on the map of the streets (Figure 3), it can be seen that LIGHT STREET was the most heavily used, mostly by teenagers and children, yet even here "children used to play on the street but now with a car every two minutes they go to the park." MODERATE STREET had lighter use, more by adults than by children, and HEAVY had little or no use, even by adults. The few reports on HEAVY STREET were of middle-aged and elderly people on the sidewalks, walking to or from somewhere and seldom stopping to pass the time of day with a neighbor or friend. Reports on MODERATE STREET indicated that the sidewalks were more heavily used by adults, especially a group of old men who frequently gathered outside the corner store. Children and some teenagers play more on the eastern sidewalk, probably because most of their homes were on the eastern side and they didn't like to cross the road except at the crossings. As for LIGHT STREET, though people continued to use the sidewalks more than any other part of the street, often the whole of the street was in use with children and teenagers playing games in the middle of the street. The sidewalks were also extensively used by children, especially because of their popular gradient and width. Again, a corner store acted as a magnet for middle-aged and elderly people, and a tennis store across the road attracted a small group of young adults. Front porches and steps on LIGHT STREET, and to a certain extent on MODERATE, were used for sitting on, chatting with friends, and by children playing. The lack of them on HEAVY STREET was regretted.

In conclusion, there was a marked difference in the way these three streets were seen and used, especially by the young and elderly. On the

one hand, LIGHT STREET was a lively close-knit community whose residents made full use of their street. The street had been divided into different use zones by the residents. Front steps were used for sitting and chatting, sidewalks for children playing, and for adults to stand and pass the time of day, especially round the corner store, and the roadway by children and teenagers for more active games like football. However, the street was seen as a whole and no part was out of bounds. This full use of the street is paralleled by an acute awareness of the physical environment as will be described in the section on identity and interest.

HEAVY STREET, on the other hand, had little or no sidewalk activity and was used solely as a corridor between the sanctuary of individual homes and the outside world. Residents kept very much to themselves so that there was no feeling of community at all, and they failed to notice and remember the detailed physical environment around them. MODERATE STREET again seemed to fall somewhere between the two extremes. It was still quite an active social street, although there was no strong feeling of community and most activity was confined to the sidewalks where at that time a finely sensed boundary separated pedestrians from traffic. The ratings reflect the differences between the three streets as mentioned above, particularly the perceived lack of meeting places for old people and play places for children on HEAVY STREET, where mean response ratings usually exceeded 4.0.

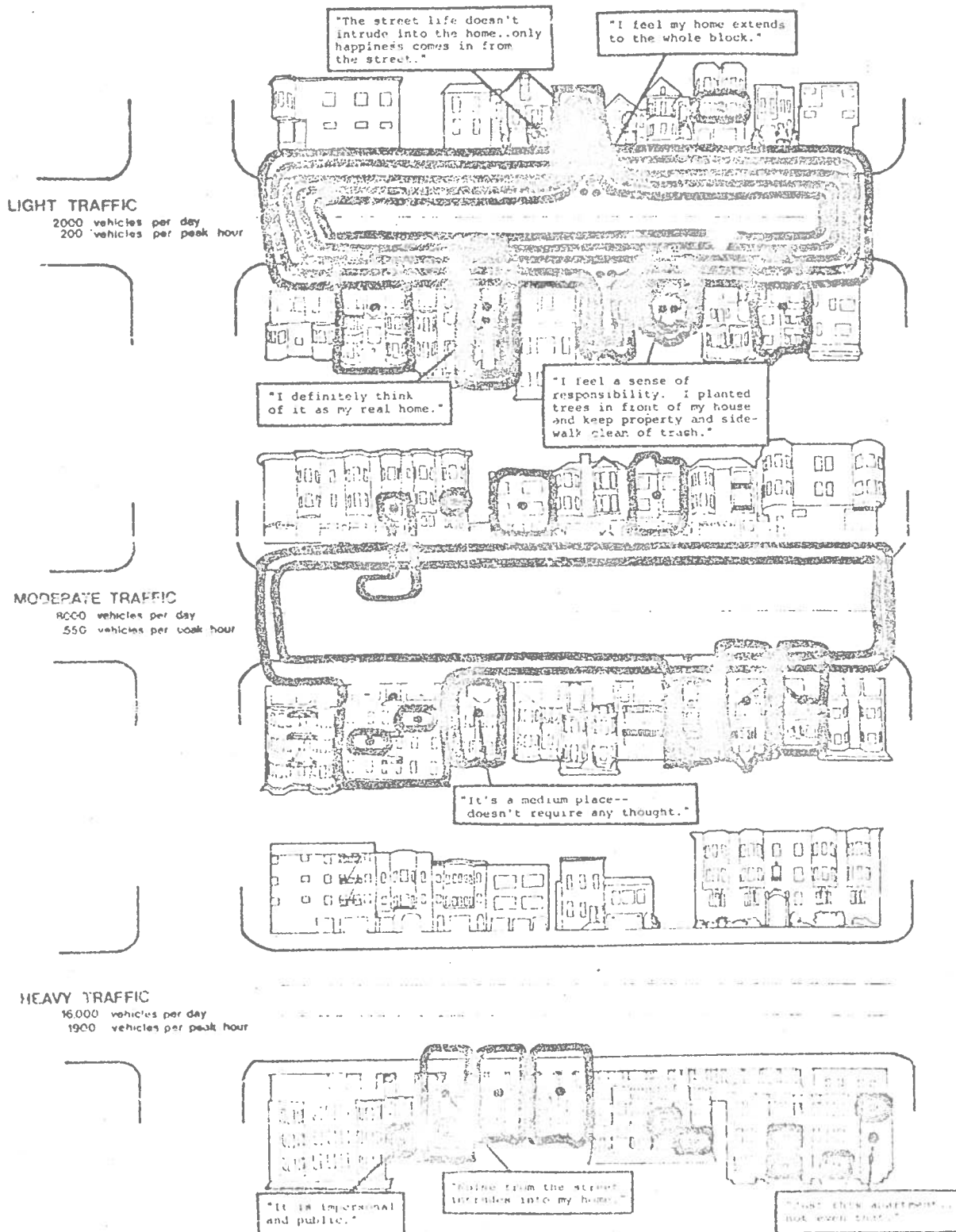
#### PRIVACY AND HOME TERRITORY (Figure 4, Table 5)

##### Quotes:

"Do you think of this street as your real home where you belong? - Definitely not. It's hard to say where we feel our home is -- Where do



STREET LIVABILITY STUDY: A SURVEY OF HOW RESIDENTS VIEW THEIR STREETS



# HOME TERRITORY

LINES SHOW AREAS PEOPLE INDICATED AS THEIR "HOME TERRITORY"

TABLE 5: Mean Ratings of Privacy-Territoriality

Rating: 1 = high, 5 = low

	HEAVY	MODERATE	LIGHT
Do you think that your street is relatively secluded?	3.4	2.1	2.4
Do you feel that your street is over-crowded or cramped?	3.3	1.6	2.0
Do you find that street life intrudes into your home at all?	2.9	1.2	1.8
Do you feel that your privacy is invaded by neighbors or from the street in any way while you are in and around your home?	2.5	1.6	2.2
Where do you feel that your "home" extends to; in other words, what do you see as your personal territory or turf?	3.0	2.3	1.2
Do you think of this street as your real home, where you really belong?	2.9	1.9	2.1
Do you feel any sense of responsibility for the way the street looks and for what happens on it?	2.6	2.8	1.3
If an outsider criticized your street would you defend it?	3.0	2.2	1.6
Do you have a garden or outdoor private space? What do you use it for? Do you miss one?	2.7	2.8	1.6
Have you devoted much time and money to improving and decorating your home?	2.8	2.2	1.4



you feel your home extends to? - Just this apartment, not even that -- There is a raging war between the residents and those terrible commuters from Marin. The residents want to dynamite patches of the road to slow traffic -- My outdoor space is the roof or the fire escape where I may have plants." (HEAVY STREET)

"I am out there with a broom from one end of the block to the other. I am known as the 'woman with the broom.'" (MODERATE STREET)

"I tend the sidewalk trees outside the house and the rose bushes in the front -- I like our little street, even though I am not a home owner -- I keep it clean of debris, pick up broken bottles, notify people of anything wrong -- Street life doesn't intrude into home. Only happiness comes in from street -- I feel my home extends to the whole block (very emphatic). -- Feel a sense of responsibility. I planted trees in front of house and keep property and sidewalk cleaned of trash -- I always clean street, take in dirt off the street, pick up nails, broken glass and paper. At least ten people take care of the street -- I definitely think of it as my real home." (LIGHT STREET)

\* \* \*

A number of questions were asked to gauge whether inhabitants felt they had sufficient privacy, and whether they had any feelings of stewardship over their streets. Again response ratings to key questions were more negative on HEAVY STREET.

General reaction to LIGHT and MODERATE STREETS was very favorable, especially amongst middle-aged residents. Great pride in their home and street was evident in their remarks. On HEAVY STREET there was little peace and seclusion, even within the home, and residents struggled to retain some feeling of personal identity in their surroundings.

Perception of individual privacy was high throughout this area which in part could come from the feeling of "privacy and seclusion that exists in any middle class area" as one respondent put it. Inevitably, in a tight knit community, like the one that existed on LIGHT STREET, life on the street tended to intrude more into a person's home than it would on a less friendly street, but the residents had achieved a good balance wherein they maintained their own household privacy and yet contributed to the sense of community. As one woman enthusiastically put it, "only happiness enters in." Children and young people often preferred that their street not be secluded as they liked to be part of things and hated to be cut off. LIGHT STREET was a very good example of a quiet street well placed in relation to other facilities. A satisfactory balance had been achieved between a feeling of privacy and seclusion, and contact with the outside world. For one, even HEAVY STREET was enjoyed for its activity. "I feel it's alive, busy, and invigorating." However, for the majority, the constant noise and vibration were a persistent intrusion into each home and ruined any feeling of peace and solitude.

Figure 4 deals with the residents' conception of personal territory. Even though legally a householder's responsibilities extend to the maintenance of the sidewalk immediately outside his building, residents on MODERATE and LIGHT STREETS considered part or all of the street as their territory. However, the HEAVY STREET residents' sense of personal territory did not extend into the street, and for some, mostly renters in the large apartment blocks, it was confined to their own apartment and no further. This pattern of territorial space corresponds to the pattern of social use of each street. The contrast between the

territorial restrictions of those living on the trafficked street and the territorial expansiveness of those on the lighter trafficked street is one of the more salient findings of the study. A consistent pattern evident in the ratings accurately reflects the tone of people's remarks wherein HEAVY STREET was seen as considerably less private, and also less identified with than the other two streets especially for those people most likely to be confined to the street, the young and the old.

INTEREST AND IDENTITY (Figure 5, Table 6)

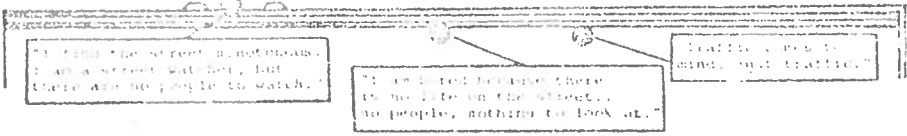
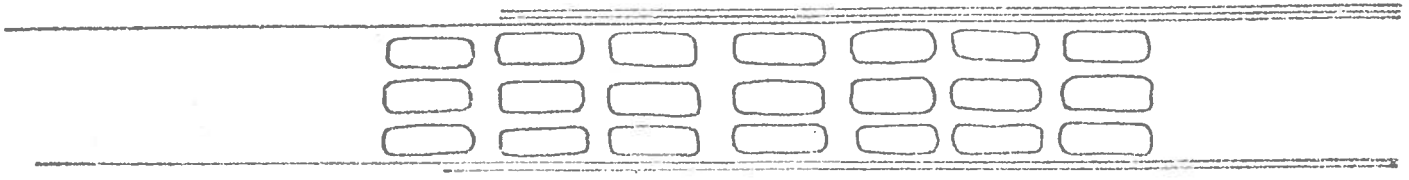
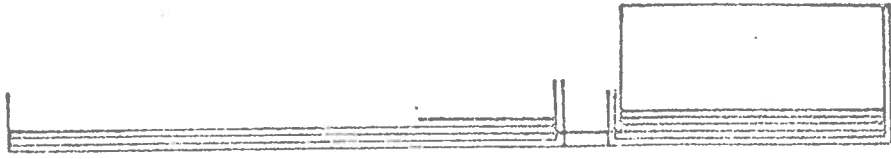
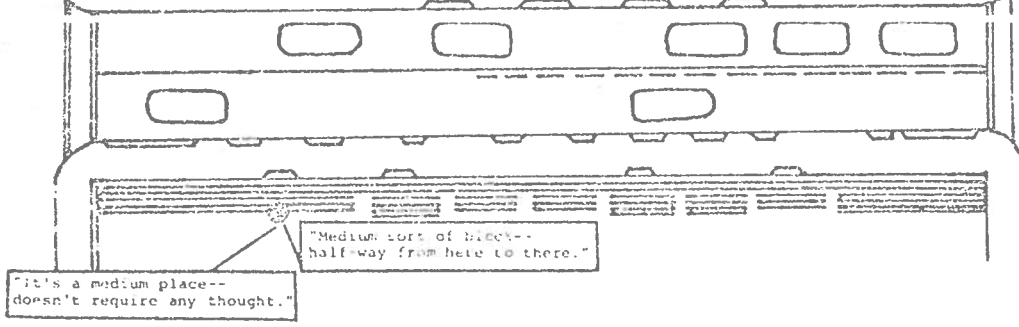
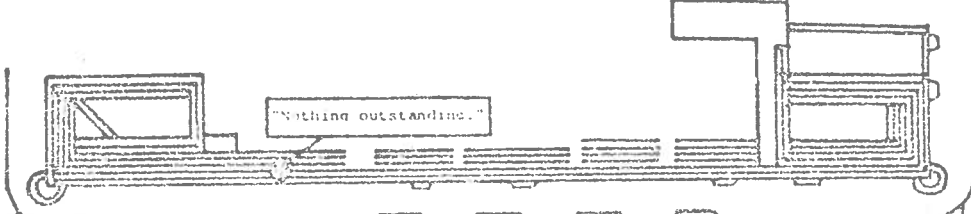
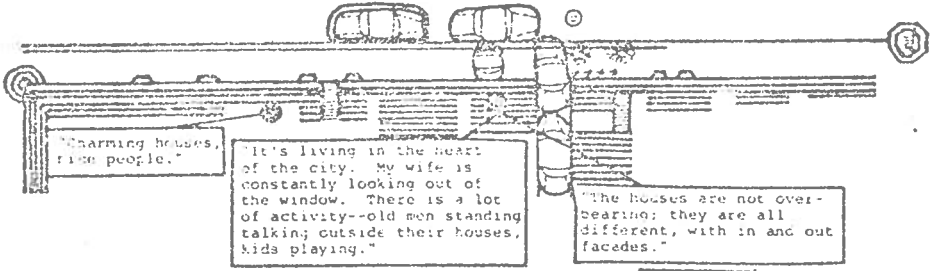
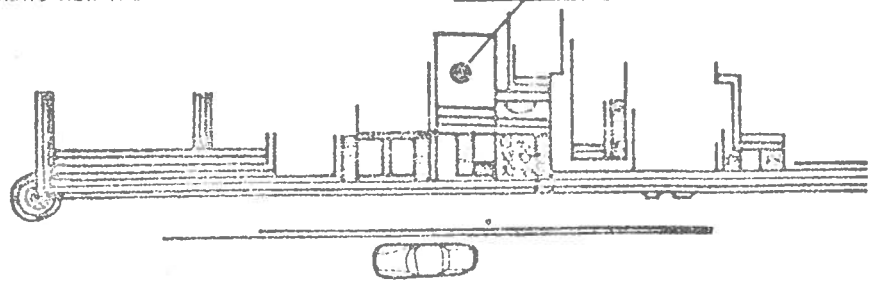
Quotes:

"I dislike the sterility of the surroundings -- I don't like the fact that there is no greenery -- The first thing that comes to mind are apartment buildings, small apartments, 5-6 units. This wasn't so until ten years ago when they made the street one-way, before that there was a feeling of neighborhood -- I am bored because there is no life, no people on the street, nothing to look at -- Physically it feels as if you are looking over a void, the street is non-existent -- The street facade is extremely unmemorable, dull brick or bland, plaster - the surfaces are flat and static -- I found the street monotonous. I am a street watcher, but there are very few people to watch -- In the morning I think I feel the street is alive, busy, active, it's invigorating -- First thing that comes to mind, fast traffic -- It's absolutely dead, not even any night life, nothing." (HEAVY STREET)

"Different from other streets in that it has a yellow line down the middle, others don't -- It's all dull, which is what I seek -- Medium

**STREET LIVABILITY STUDY:  
A SURVEY OF HOW RESIDENTS VIEW THEIR STREETS**

"Variety of people, all ages. People sit on front steps and chat, visit each other. It's a comforting block, very cheerful."



**IDENTITY AND INTEREST**  
COMPOSITE OF MAPS PEOPLE DREW OF THEIR STREETS  
LINES INDICATE NUMBER OF TIMES FEATURE WAS DRAWN BY RESIDENTS

TABLE 6: Mean Ratings of Identity-Interest

Rating: 1 = high, 5 = low

	HEAVY	MODERATE	LIGHT
Do you find your street and the life that goes on there interesting? Do you get bored by life on this street, do you find it monotonous?	3.3	2.9	2.3
What parts of the street do you like most?	3.1	2.6	2.1
What parts do you find least attractive?			
What comes first to mind when you think of your street?	2.3	3.1	2.5
Could you please try to draw a map of what you think of as this street showing all the features of the street and the buildings that stick in your mind no matter how trivial they seem to be.	2.7	2.5	2.1
Do you think this street is different from surrounding streets, is it special or unique in any way?	2.2	3.6	2.1
Do you think there are many different kinds of people on this street? Can you describe them?	3.4	2.1	1.8

sort of little block, half way street from here to there -- First thing that comes to mind, cars especially." (MODERATE STREET)

"The houses are not overbearing, they are all different with varigated in and out facade -- It's like living in the heart of the city, my wife is constantly looking out of the window. There is a lot of activity - men standing talking outside their houses, the kids playing, etc. -- Variety of people, all ages. People sit on front steps and chat, visit other people. It's a comforting block, very cheerful -- I like the set backs, they give individuality." (LIGHT STREET)

\* \* \*

Street dwellers were each asked to recall all important features of their streets, to adjudge whether their street was in any way different from surrounding streets, and to draw a map of their street.

Figure 5 is a composite of all the maps that each person drew for his own street. The responses to the questions were much richer in content -- and more critical in character -- on LIGHT STREET than on the other two streets. This can be partly explained by the greater differentiation of front yards and smaller houses, but it clearly stemmed from an increased awareness of the street environment by the residents themselves.

Interest in the street as evidenced by their maps varied by age group. LIGHT STREET had tremendous appeal for children who recalled individual buildings, front yards, steps, particular parked cars, manhole covers, telegraph poles and even the brickwork setting around the base of a tree. Many of these elements were obviously encountered during their play on the street. On MODERATE STREET, where there was

less street activity, the maps of children and young people were accordingly less rich.

Middle-aged people on the other hand seemed to be aware of more facets of the physical environment. Their recollections included a combination of buildings, details of the sidewalk and roadway, and the traffic itself. Their image of their street was more of an impression than a precise recollection. For them, LIGHT STREET was seen as a collection of individual buildings with detailed differences in front yards and porches. MODERATE STREET was much more straight-walled with accurate detailed memories of driveways, pedestrian crossings and road markings (possibly because it was seen as a traffic route with finely defined boundaries).

HEAVY STREET was seen almost overwhelmingly as a continuous traffic corridor, straight-sided without a break for cross streets and packed with cars. The traffic itself was an easily identified characteristic of the busier street. Whether this identity was good or bad is another matter.

As for the responsiveness of the street environment to the needs of the street dwellers, LIGHT STREET once more showed up well. Already two trees had been planted in the sidewalk, other plants were thriving in the occasional front yard and flower boxes were prevalent. On HEAVY STREET, the sidewalks were too narrow to allow anything except the very small bushes that flanked the doors of one or two apartment buildings.

## STUDY CONCLUSIONS

1. The intensive traffic conditions on HEAVY STREET did, in fact, lead to considerable stress and suffering. Those people who had found it intolerable, especially those with children, had moved elsewhere, and the people who lived there at the time of the survey had either withdrawn from the street or had never become engaged in it. They only used it when they had to, they had few local friends and acquaintances, and they had become oblivious to the street as a living environment. If they could, they lived at the backs of their houses. For those who treated it as a transient residence, this condition was tolerable, but those who had to treat it as a permanent residence, because they were too old or too poor to leave, found it an intolerable condition.

In contrast, those who lived on LIGHT STREET were very much engaged with it. They saw it as their own territory. Their children played on the sidewalk and in the street. They had many friends and acquaintances (over twice as many each as those on the HEAVY STREET), they noted many more features of the street when they were asked to make a drawing of it, and they were generally much more aware of their street. Despite all this, the rents on HEAVY STREET with its inferior living environment were higher, perhaps because the apartments and the street were more available to a transient population, through their higher exposure and turn-over.

As for those who lived on the MODERATE STREET, their living conditions lay somewhere in between the other two, but their level of satisfaction was lower than their middle position might suggest.



From our results it appears that we can draw some conclusions about the effects of traffic on the environmental and social quality of these streets.

- a. Heavy traffic activity was associated with an increase in the number of apartment buildings and decrease in the number of single-family homes and number of families with children. The income levels of the residents remained the same or increased.
- b. Heavy traffic was associated with a drastic decrease in social interaction or street activity. Conversely, a quiet street with little or no traffic, families, etc., promoted a rich social climate and strong sense of community.
- c. Heavy traffic was associated with a withdrawal from the physical environment. Conversely, the street with low traffic showed evidence of acute, critical and appreciative awareness of and care for the physical environment.
- d. It seems fair to say, then, that in this case objective and perceived environmental quality deteriorated with increased traffic.

2. There are some exceptions to the above conclusions. MODERATE STREET suffered from ambiguity of identity since it was undergoing a change in character turning from a quiet residential street into a major traffic corridor. Many subjects were more dissatisfied than those on HEAVY STREET, because they chose or were brought up to live on MODERATE STREET for its livability and it had not turned out that way. Their original expectations for the environment were higher than those who chose to live on HEAVY STREET and the disappointment was therefore greater.

On LIGHT STREET the sporadic hot-rodder was in some ways perceived as worse than the traffic on HEAVY STREET for similar reasons. When people expect traffic to be heavy, traffic is tolerated. When they expect it to be light, a hot-rodder is especially intrusive. In conclusion: People were dissatisfied with the lightly trafficked street when their environmental expectations were not realized either through relative decline from a previously higher quality or from deviant traffic behavior.

3. The pattern of interview responses suggested that the issues of safety, stress, condition, pollution, privacy, territoriality, followed closely by neighboring were of primary concern to the inhabitants of all the trafficked streets. Issues such as identity, interest, appropriateness, and self-expression were not considered important until the former reached a tolerable level.

4. The general trend was towards increased traffic on each of the three streets with the prospect that the environment of each street would decline further.

## DISCUSSION OF CONCLUSIONS

Objective observations of environmental quality, through traffic flow and noise counts, showed that environmental conditions on HEAVY STREET were particularly severe and though complaints were numerous, they were not quite so strong as one might reasonably expect. There had been no public protests by any organized group. Why was this?

One major reason appears to be that the erosion of environmental quality had been subtle and slow over a period of ten years or more. During this time the workings of environmental self-selection, and environmental adaptation had been allowed to operate. These are important phenomena to consider in measurements of response to environmental quality.

The workings of environmental self-selection may be stated thus. An environment tends to encourage those groups who find it most amenable to select it, and those who find it least amenable to reject it. Hence when traffic increased on HEAVY STREET, families with children moved away, single people and couples whose local environmental needs were less, but who valued accessibility tended to replace them. The principle however does not work perfectly. Those who are unable to select an environment through lack of financial, informational, or emotional resources, are those likely to suffer the most from deteriorated environmental quality. In this case the older people on HEAVY STREET experienced severe discomforts, and the families on MODERATE STREET who had to remain, experienced the loss of friends.

As for the workings of environmental adaptation, the literature in this research field (Sonnenfeld, 1966, Wohlwill, 1968) and the

findings of this study, might express them thus: Those who remain in one environment for a length of time will become adapted (or resigned) to it whether or not it is or has been pleasant, especially if they see no future change in sight. Evidence for this can be found in some of the more indifferent responses on HEAVY STREET.

These individual and family adjustments to a deteriorating environment were further muted because there was no clear public target for resentment, only the individual automobiles and trucks. No particular agency was threatening the environment or initiating changes. This worked both ways, their hopes were not raised that anything would be done about their problem, neither were their frustrations focussed sufficiently for them to band together in protest.

Despite the private nature of the adjustments and the slowness of the deterioration, a majority of the inhabitants on the trafficked streets were still well aware of their plight, as their comments tell.

One final and more positive finding of this study was what it told us of life on a 'good' residential street, namely LIGHT STREET. Since we cannot hope to improve urban environments without some positive goals to work towards, LIGHT STREET performs a critical function. In Appendix A to this report we have tried with the help of these interviews, to picture what a truly livable urban residential street might be like.

## RESEARCH IMPLICATIONS

The results of this study are suggestive but obviously unrepresentative. Our a priori groupings of issues under criteria headings proved a useful way of organizing the interviews and observations. A broader study examining a large number of street conditions and types of population is clearly required. Such a study should include:

1. A more structured questionnaire that would allow subjects to make their own ratings and selections from adjective and other check lists (Craink, 1967, Shaffer, 1967).
2. A more comprehensive set of observable and objective indicators of environmental conditions besides accident rates and noise levels, counts of street activity, closed windows, drawn blinds, parked cars, trash, flower boxes, and other signs of personal interest might be established as important predictors of environmental response.
3. A finer assessment of traffic variables, including flows at different times of day and night, speed levels, traffic composition, traffic control signals and so on.
4. Multivariate analyses of interviews, traffic composition, and environmental indicators would then allow us to understand the ways in which factors tend to cluster, and to develop predictive models from regression analyses of response to various conditions. With such models, indices (similar to the Traffic Noise Index) could be established to predict a wider range of phenomena such as levels of privacy, neighboring, street identity, stress, and sense of safety for residential streets.

5. One of the most urgent research needs is to develop the ability to predict the flow and speed of traffic from environmental conditions, given the desire lines operating in an area. The purposes may not always be the usual ones of trying to increase capacity, but rather they might be to limit capacity and to control speeds at environmentally acceptable levels. We know that signs alone do not control speeds. What are the effects of rough surfaces, trees, necking down, and bends on these traffic variables?
6. Another research need is for surveys to assess the numbers of people who actually live under the deteriorated environmental conditions of heavily trafficked streets. A recent book (Thompson, 1970) calculated that one million people in London would be living within 200 yards of their proposed motorway system. The implication was that one million people would be suffering from a deteriorated environment. It may well be, however, that as many people are subjected to worse environmental conditions on the arterial streets of that city. Such accounts of conditions in a U.S. metropolitan area might have a significant impact on the allocation of investment to environmental improvements.

#### Policy Implications: Proposals and Standards

Policy usually has to be made without the benefit of adequate research and this project was no exception. It may be useful to summarize them here since they themselves point towards other research needs.

Environmental improvement proposals were made assuming different levels of investment. Many of them were suggested by respondents in the interviews.

#### Environmental Proposals

1. The broadest implication of this study is that through-traffic should be eliminated or at least reduced in the residential areas of the city by devices such as improvements in public transit, controls on the use of streets for traffic, and the location of parking facilities in closer relation to freeways.
2. Vehicular traffic should be more concentrated on the main arteries of the city, where there is less residential development, by increasing their capacity through separated grades, selective widening, parking controls, etc.
3. Residential streets should be protected from through-traffic by blocking them altogether, or by devices such as rough pavement surfaces, necking down entrances, bending alignments, landscaping, and sidewalk treatment, all of which would slow traffic down to a residential pace. For inhabitants on HEAVY STREET only slight adjustments in traffic speed and composition would have resulted in a marked improvement of their conditions.
4. On streets where traffic flows and speeds cannot be reduced ways of ameliorating conditions were proposed. These included sidewalk protection, by means of trees, low walls, hedges, etc; the provision of alternative play spaces to divert children's activities away from the dangerous street; the protection of residences from glaring street lights and other visual distraction

through the planting of trees, etc.; the clear definition of parking spaces; and the encouragement of inhabitants to exercise some interest in their own front yards and sidewalks through provisions for private planting, benches, etc.

#### Environmental Standards

The ultimate policy aim of research in this field should be to set environmental standards of livability for residential streets. In Appendix A we have proposed a set of criteria, which might be termed Environmental Rights for those who live on residential streets. These rights are no more than generalities at this time. We do not have specific scales by which achievement of those rights can be measured, neither do we know which levels or ranges are desirable, nor do we know how important they are or will be to different population groups. The Buchanan Report identified certain groups including the young and the elderly as particularly 'vulnerable' to traffic hazard and nuisance. All we know is that they might be very important.

Even with our lack of evidence, it is still necessary to begin formulating what might be acceptable environmental conditions on residential streets. We need sets of environmental performance standards, -- environmental capacities to which traffic levels should conform. These standards will have to be measurable whether in terms of decibels, accident rates, or measures such as delay times for pedestrians crossing the street, which the Buchanan Report used (HMSO, 1963). Standards such as these are now being applied in Britain as guidelines for the reorganization of traffic in residential areas, even though they are still relatively unsubstantiated by empirical research (G.L.C. 1968).



The development of such standards in the United States may be difficult because most urban streets are under the jurisdiction of local public works and planning departments, where funds for environmental improvements are limited, and where the development of standards is usually carried out on an ad hoc basis. A national program for the improvement of environmental conditions on urban streets should be initiated.

The environmental problems described in this paper have not caused public protest, neither are they as dramatic as some of the more remote ecological disasters; yet they have an impact on the everyday life of millions of people in this country, for everyone lives on a street. This is an environmental problem that has somehow been 'hidden' from the public eye. Attention should be given to it.

## Appendix A.

Environmental Rights of Street Residents

In order to determine desirable levels of safety, noise, cleanliness, privacy, sense of territory, neighboring, street activity, and environmental interest and identity, we have tried to develop a set of environmental rights of the street residents relating to the five criteria mentioned in this study. The five criteria are:

1. Safety: the environment of the street should be safe at all times, especially from the hazards of traffic, both for the resident and stranger, for pedestrians, children, pets, and the elderly. It should be possible to move freely in the locality during the day and night without fear.
2. Stress, Noise, Pollution: The environment of the street should not create stress related to noise, vibration, glare, poor lighting, dirt, pollution, and poor sanitation, especially for residents at night, children playing around the home during the day, housewives and the elderly. It should be possible to sleep and study in the home without disturbance from outside, for children to play on the sidewalks and across the road. It should be possible to attain a high standard of maintenance, degree of planting, and quality of decoration and design to reflect the self-esteem of the residents.
3. Privacy and Home Territory: The environment of the street should protect a resident's right to be left alone. It should respect his private domain. It should encourage the feeling that the street belongs in part to the people who live on it. They should

have some degree of control and jurisdiction over its detailed design, planting, street lighting, design of pavement and sidewalks, signs, street furniture, etc. It should be possible to have complete privacy in the home and general seclusion in all private outdoor spaces, such as backyard, patio, front porch. It should be possible to adapt the physical environment immediately around the home to meet individual needs and preferences.

4. Neighboring and Visiting: The environment of the street should facilitate social interaction between neighbors, and people on the street when they desire it. A feeling of local community should be encouraged for the well-being of local people and their self protection against intruders, whether they be automobile drivers, highway or planning agencies. As a cohesive unit a local community has a stronger voice in the broader discussions of city-wide issues and concerns, as well as more efficient control over local problems of vandalism and crime.

5. Identity and Interest: The street environment should represent openly the activities and way of life of the people who use it. For children the street is an introduction to the life of the city and the larger world. It should therefore be seen as an educational environment for them. It should be differentiated from surrounding streets and should feel like a destination and a focus of local activity. At a smaller scale each dwelling unit should have its own individual identity. The different elements of the street should be distinguished by their special character and form. The street should present a wide variety of experiences and opportunity to undertake different activities especially for the immobile young and old.

## BIBLIOGRAPHY

1. Abt Associates, Inc. "Qualitative Aspects of Urban Travel Demand," Cambridge, Mass. 1968.
2. Appleyard, D., and K. Lynch. "Sensuous Criteria for Highway Design," in J.L. Schofer and E.N. Thomas, "Strategies for the Evaluation of Alternative Transportation Plans," Research Report, The Transportation Center, Northwestern University, Evanston, Illinois, 1967.
3. Appleyard, D., and R. Okamoto. "Environmental Criteria for Ideal Transportation Systems," in "Guidelines for New Transportation Systems," ed. Barton Aschman Associates for U.S. Department of Housing and Urban Development, Washington, D.C., 1968.
4. Craik, Kenneth H. "The Comprehension of the Everyday Physical Environment," Journal of the American Institute of Planners, 1968, 34. pp 29-37.
5. Ellis, Raymond H. "Toward Measurement of the Community Consequences of Urban Freeways," paper prepared for 47th Annual Meeting of the Highway Research Board, 1968.
6. Greater London Council. "Kensington Environmental Management Study," publication 39, London, 1966.
7. Griffiths, I.D., and F.J. Langdon. "Subjective Response to Road Traffic Noise," Journal of Sound and Vibration, 1968, 8(1) pp. 16-32.
8. H.M. Stationary Office. "Noise: Final Report," committee on the problem of noise, 1968.
9. H.M. Stationary Office. "Traffic in Towns," (The Buchanan Report) London, 1963.

10. Kaplan, M., S. Gans and K. Kahn. "Social Reconnaissance Survey, Part 2," San Francisco Urban Design Study, San Francisco City Planning Department, 1969.
11. Keller, Suzanne. "The Urban Neighborhood: a Sociological Perspective," Princeton University, Random House, New York, 1967.
12. Manheim, Marvin. "The Impact of Highways upon Environmental Values," Urban Systems Laboratory, M.I.T. Cambridge, Mass., 1969.
13. Owen, Wilfred. "Transport: Key to the Future of Cities," in H. Perloff, ed. The Quality of the Urban Environment. Essays on 'New Resources' in an Urban Age. Resources for the Future, Inc. The Johns Hopkins Press, Baltimore, Maryland.
14. San Francisco City Planning Department. Preliminary Reports Nos. 1 to 8, San Francisco Urban Design Study, 1969-70.
15. Shaffer, M.T. "Attitudes, Community Values, and Highway Planning," Highway Research Record, No. 187. Highway Research Board, 1967.
16. Sonnenfeld, J. "Variable Values in Space Landscape," Journal of Social Issues, 1966. 22. pp. 71-82.
17. Thompson, J.M. "Motorways in London," published for the London Amenity and Transport Assoc., Andworth and Co. Ltd., London, 1970.
18. Wohlwill, J.F. "The Psychology of Stimulation," in R. Kates and J.F. Wohlwill, ed. Journal of Social Issues, 1966. 22. pp. 127-136.