

# TRAFFIC AND LIVABILITY IN HANOI, VIETNAM

Exploring the impact of traffic volume on livability of residents in Hanoi

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## Abstract

Urban transport is one of the most daunting problems faced by South East Asian cities. Research from the resident perspective in the developed world reveals that urban transport can severely affect livability of residents. However, such empirical evidence has yet to be obtained in South East Asia. This Master thesis evaluates livability of residents along streets with different traffic volumes in Hanoi, a rapidly growing metropolis characterised by high levels of personal motorized traffic in Vietnam. Two high volume traffic streets and two low volume traffic streets are studied. The study results show that – as expected – low traffic volume streets were rated more livable than high traffic streets. The study is able to quantify that residents on both low traffic volume streets experience less traffic hazard and stress, including noise and air pollution, than neighbouring high traffic streets. Though, interestingly, the level of social interaction and feeling of privacy and home territory were fairly high at all four low and high traffic streets.

The methodologies used for this explorative study were revisiting the famous 1969 “Livable Streets” project by Donald Appleyard and Mark Lintell. Like the original study, it compared responses of residents on streets with high and low traffic volumes and measured the effects on social interaction, stress, traffic hazard, and privacy and home territory. Appleyard found all four indicators to correlate inversely with traffic volume in San Francisco. However, the new study shows for social interaction and a feeling of privacy and home territory contradictory trends. This is most likely a consequence of contextual differences between Hanoi and San Francisco, such as average length of residence and level of individualism. Responses were nevertheless muted for a number of probable reasons, including residential self-selection, socio-demographic differences and physical differences other than traffic volume between the streets.

## Acknowledgements

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## Abbreviations

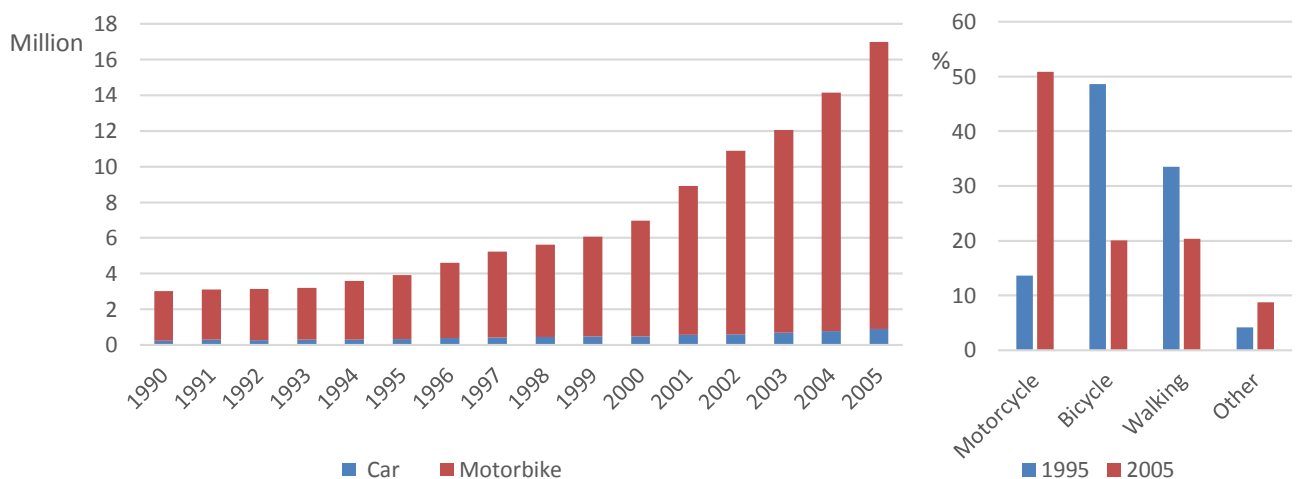
<i>Df</i>	Degrees of freedom
<i>F</i>	Levene's Test for equality of variances
<i>M</i>	Mean
<i>N</i>	Sample size of a particular group
<i>P</i>	Probability (the significance of a <i>t</i> -test is denoted by <i>p</i> )
PCE	Personal car equivalent
<i>R</i>	Pearson's correlation coefficient
<i>SE</i>	Standard error
<i>Sig.</i>	Significance level
<i>T</i>	Test statistic for Student's <i>t</i> -test



# 1 Introduction

*“Nearly everyone lives on a street. People have always lived on streets. They have been the places where children first learned about the world, where neighbours met, the social centres of towns and cities, the rallying points for revolts, the scenes of repression” Appleyard, Gerson and Lintell (1981, p. 1).*

More than 50% of the world wide population lives in urban environments, which is increasing even further with the current metropolization trend (Boquet, 2009). Most of this growth is expected to take place in the developing world. Besides, estimates of the World Health Organization (WHO) indicate that 49% of the worldwide road fatalities happen on streets in low- and middle-income countries in South-West Asia and the Western Pacific (Peden, 2004). Particularly, the high share of vulnerable, relatively high-speed, motorcycles causes many of these accidents. Hanoi, the capital of Vietnam is a city in the middle of this region that suffers from low traffic safety, congestion, pollution, noise and a dominating presence of personal motorized vehicles on a little road space (see Figure 1; Huong, 2011; Japan International Cooperation Agency, 2007). These problems do not only affect the transport system, their influences might reach deeper. Geertman (2010, p. 2) describes that in Hanoi “the car/motorbike based urban development is greatly affecting quality of life, public health and the sense of well-being in the city”. In the western world, empirical evidence indicates that traffic can also seriously influence livability of residents along streets (D. Appleyard et al., 1981), as is discussed below.



**Figure 1.** (left) Growth in motorized traffic in Vietnam, 1990-2005 (as cited in Geertman, 2010, p. 2) and (right) modal share in 1995 and 2005 in Hanoi (Hanoi People Committee and JICA, 2006)

Appleyard, in his famous 1969 study, measured the differences in livability along residential streets in San Francisco that vary in levels of traffic volume, but are otherwise, i.e. physically, the same. He was able to show that cars in San Francisco, with the envelope of danger they project around them, the noise and pollution, crush the quality of life of neighbourhoods. His results have been discussed by many generations of transport professionals. Yet, of interest is whether Appleyard’s findings are also valid in the context of a city like Hanoi. Particularly, the different context of Vietnam as a fast growing new middle-income country in South East Asia might reveal new insights that complement to the Appleyard study results. This research investigates how residents perceive residential quality of life along four streets in Hanoi. Before going further to the theoretical framework (chapter 2), methodology (chapter 3) and results, conclusions and recommendations (chapter 4 and 5), a further introduction to the case study city Hanoi, the aims and objectives of this study and the partners involved will be given.

## 1.1 Hanoi and Transportation

Hanoi is the case study city in this thesis. It is a mono-centric fast growing metropolis with a population of 6.4 million people that is expected to reach 11 million in 2030 (PPJ, 2011). It is recognized as one of the most overcrowded cities in the world. In 2008, human densities in the urban districts reached an average of 272 persons per hectare and up to 404 persons per hectare in the historic core, compared to 370 persons per hectare in Hong Kong, 86 in Paris, and 62 in London (Danielle, 2010). Urban transportation is primarily composed of roads. Hanoi's traffic is characterized by a mixture of cars, motorbikes, bicycles, trucks and buses, in which 1.5 million motorcycles dominate the street (Worldbank, 2008). Currently Hanoi is experiencing an exponential growth

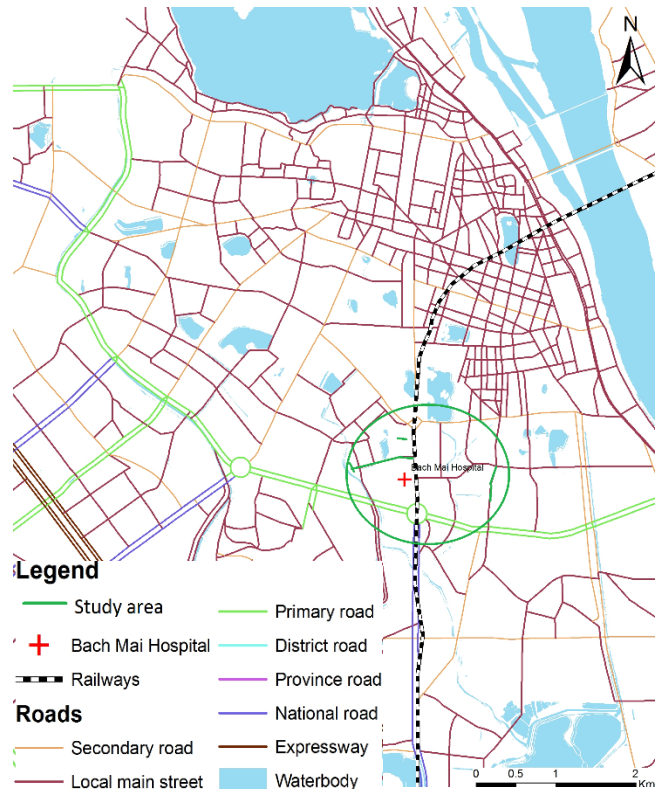


Figure 2. Transportation network of Hanoi, 2005 (Haidep, 2005)

in the number of motorcycles and cars (JICA, 2007). The result of this rapid growth is heavy air pollution due to the millions of engines running on a limited road surface in a very dense city. Apart from pollution and a dominating presence of personal motorized vehicles, there is a decreasing numbers of bicycles, and a low share of public transport, posing problems to the transport system (JICA, 2007). The city issued an impressive Master Plan study proposing numerous changes as for example metro lines combined with Bus Rapid Transit feeder lines and the provision of a solid road network preventing bottlenecks. While the first metro line and much road construction is already under construction, Hanoi formulated its vision for 2050, aspiring to become the "symbol of the nation" by having "a good living environment" (PPJ, 2011, p. 5). Hanoi is a crowded, rapidly growing city and seems relatively open to change.

### *Hanoi compared to other Asian cities*

A collective culture (Hofstede, 2001), high densities, and a motorcycle domination are not only seen in Hanoi; actually, they are characterizing most South East Asian cities. Many cities in Asia have already developed their transportation systems, and became car dominated in recent decades like for example Beijing and Kuala Lumpur, or are based on mass rapid transit systems such as Singapore. In the former type, the cities have become polluted due to the many cars, while in the latter the cities' fabric had to be sacrificed for the public transit system. While Hanoi is still in a relatively early phase of development it not too late to look for alternatives, for example by developing a smart and sustainable transport system as described by Hull (2008) Melia, Parkhurst, & Barton (2011) and even long time ago by Appleyard (1981).

## 1.2 Hanoi compared to San Francisco

A comparison between Appleyard's San Francisco and Hanoi may not sound logical, since indeed both cities are pretty different. For example, San Francisco, which had a low density and where people commuted mostly by car, Hanoi is a dense city where people mainly commute by motorbikes. Another great difference from Hanoi with San Francisco is the culture, which in Hanoi is characterized by a collective social structure. The communistic Hanoi has a much more collective culture (Hofstede, 2001).

Loyalty, trust, and mutual obligations are very important to interpersonal relationships in a collective culture (Richards et al., 2012). People organize themselves in collectives, and live in extended families, live in neighbourhood collectives, and have often strong collective social engagements in the neighbourhoods they live in. Whereas San Francisco has a more individualistic social structure (Hofstede, 2001). According to "the moral worth of the individual", individuals aim to promote their own goals and desires and oppose external interference by society or institutions (Wood, 1972, p. 6). Concluding, three distinct key differences between the context of Hanoi and San Francisco are difference in population density (very dense versus-low dense), difference in mode of transport (cars versus motorbikes), and difference in culture (collective culture versus individual culture).

### 1.3 Why still revisit Appleyard in Hanoi, 40 years later?

Today, more than 40 years after Appleyard's study we can still witness the domination of motorized traffic in most cities around the globe. Newman and Kenworthy (1999) explain for South East Asia that "the car became a symbol for 'a way to the future', its influence first came from the enormous prestige of the USA and the West, in general, and made all local elites focused on highway construction and car-based cities". Hanoi, started its urban development much later than most of the other South East Asian neighbours. However, the city is very much following the same car based urbanism approach. Given the current problems of the Hanoi' transport system, it might be useful to collect evidence of the effect of traffic volume on urban livability as a contribution for the debate about sustainable traffic planning. The Appleyard study might contribute to more awareness of the heavy burden of motorized traffic to public health and general wellbeing of the urban citizens in Hanoi. When a child firsts meets the world, let it be at a child friendly street in Hanoi. This study therefore seeks to make the impact visible of heavy traffic on livability of residents along residential streets in Hanoi.



Europe, 1970s



Hanoi, 2010

**Figure 3.** Personal motorised vehicle domination in Europe versus Asia (as cited in Geertman, 2010).

## 1.4 Research questions and contribution

Based on the previous discussions the following main objective has been formulated for this research:

*To assess the impact of traffic volume on livability of residents along residential streets in Hanoi.*

Appleyard found three highly similar parallel streets for his pilot study. For this study, therefore, the first step will be to select a suitable study area in the highly dynamic and vibrant built-up environment of Hanoi. Then the study moves forward to measure how livable these different streets are. Finally, by comparing livability along these streets with different traffic volumes, draw lessons and conclusions on the impact of traffic volume on livability in the context of Hanoi. This also follows from the research questions below.

Main research question:

1. *What can be learned from measuring and comparing livability of residents along streets with different traffic volumes in Hanoi?*

Sub research questions:

- 1.1 *Which residential streets can be distinguished with different levels of traffic volume while other physical variables remain constant in Hanoi?*
- 1.2 *What is the livability of residents along streets with different traffic volumes?*
- 1.3 *What can be learned from comparing livability of residents along streets with different traffic volumes in Hanoi?*

Apart from traffic volume, other environmental variables might determine livability. The goal is to keep the influence of these other variables at a minimum. Three environmental variables other than traffic volume are identified: street environment, socio-demographic characteristics of residents and residential self-selection. With a sample 180 respondents that are not randomly selected throughout Hanoi, but on 4 selected streets this will be an explorative study. It measures the perception of residents on livability related to different traffic volumes through a survey along streets with different traffic volumes (2 heavy and 2 light traffic volume streets). In-depth interviews and observations are conducted to support results.

### Contribution of the study

Doing so this study seeks to contribute both to local evidence to support local action as well as to contribute to the science of transport in the context of rapidly developing countries. In other words:

- *Social contribution: The collected evidence of the impact of traffic volume on urban livability. This knowledge can directly be used by HealthBridge Canada, to advocate for more sustainable transportation systems in Hanoi.*
- *Scientific Contribution: This study contributes to new knowledge to Appleyard's study in the context of a dense South East Asian city, as well as contributes to the debate about sustainable traffic and transport planning for South East Asian cities.*

How this research is unique in the field of sustainable transport is explained in the next chapter, theoretical framework. This chapter concludes with describing the partners in this study and an outline.

## 1.5 Partners in this study

The Master thesis in Civil Engineering & Management in the Faculty of Engineering Technology of the University of Twente in The Netherlands, is conducted in cooperation with both the Faculty of Geo-Information Science and Earth Observation (ITC) of the University of Twente, and HealthBridge, Canada from their Vietnam office. This research is part of HealthBridge Livable cities program, which aims to (re)design cities for people rather than vehicles.

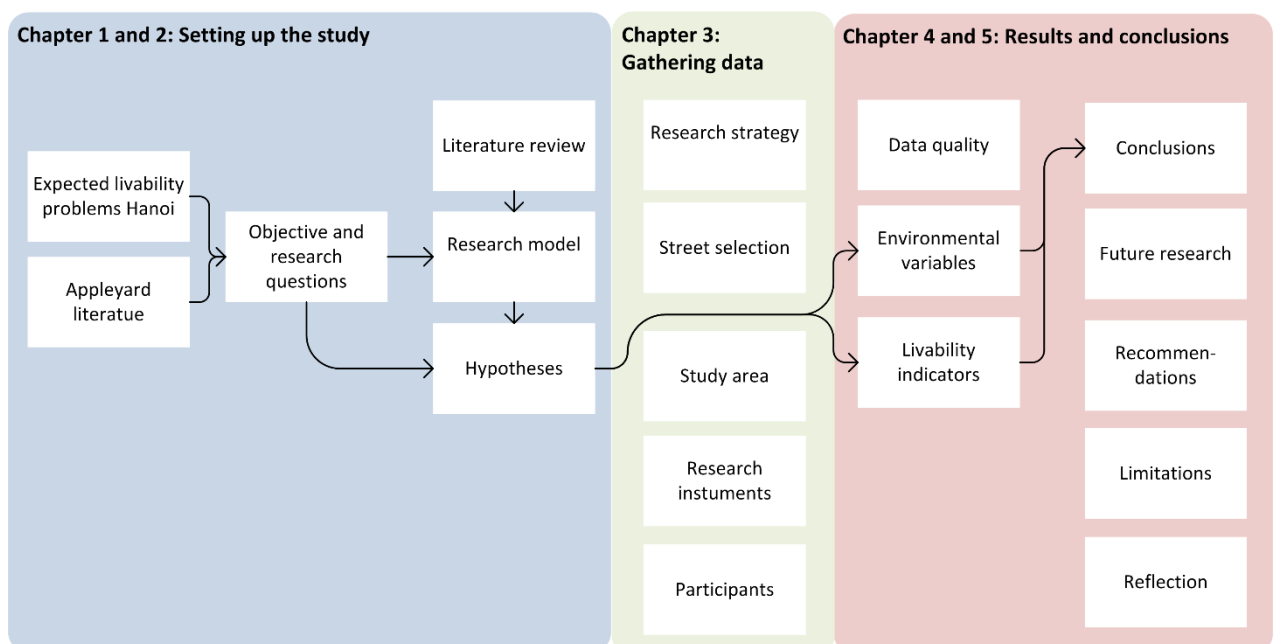
## 1.6 Research outline

The first stage of this research consisted of exploring the problem of livability along heavy traffic streets in Hanoi, exploring a suitable theory to measure livability and setting up a study. Appleyard was very successful in investigating this problem in the western world. Based on his example and the Hanoi case the current chapter formulated the study objective and research questions. Then, after a more in-depth literature review, the second chapter continues with Appleyard's theory as the main basis and developed a research model accordingly. With this model the research questions are supported with some newly developed hypotheses based on Appleyard's operationalisation of livability. One additional hypothesis aims to exclude the effect of other environmental variables than traffic flow on livability (see Figure 4).

The second stage gathers empirical data for the Hanoi case. The methodology consists of the following components: a research strategy, study area, research instruments and participants (see Chapter 3). The research strategy is a field experiment at light traffic streets and heavy traffic streets in Hanoi. Finding an appropriate streets in Hanoi was expected to be rather difficult, yet vital for the study. A focus group identified suitable potential streets in Hanoi and guided the selection process. After visiting about 15 locations, the best location is chosen according to criteria specified in the street selection (see Section 3.2). The chapter continues with describing the street selection process, and the final study area. With this information the first sub research question entrusted with finding an appropriate study area is answered.

Chapter three also develops the research instruments (see Section 3.5). The principal instrument is the survey, which is adapted from Appleyard. It is adjusted to the Hanoi context with a process of creating, evaluating and selecting survey questions. All selected survey question relate to one of the hypotheses. A multi criteria analysis is set up to aggregate question responses to constructs. The chapter concludes with describing the study participants, the sample size and socio-demographic characteristics of the sample.

In the final stage the study moves to the results and conclusions. First, chapter four determines the data quality of the gathered data with frequency distributions of questions, and the internal consistency and validity of constructs (see Section 4.1). Then, it tests the hypotheses starting with assessing whether three environmental variables other than traffic flow effect livability in the experiment: self-selection, socio-demographic resident characteristics and the street environment (see Section 4.2). The other hypotheses assess the relation between traffic volume and livability indicators. The outcomes of questions and constructs are displayed per street and illustrated with quotes from the in-depth interviews. The heavy traffic street results are compared with those at light traffic streets. Chapter 5 ends the study with conclusions, future research, recommendations, limitations and a short reflection.



**Figure 4.** Research outline. The arrows represent the leading thread running through the study.

## 2 Theoretical framework

The theoretical framework discusses how built-up environments can influence livability in general, and within the context of traffic in developing countries. Appleyard's well-known 'Livable Streets' project discusses the influence of traffic volume on livability in a western society. The theory of Appleyard provides five key indicators to measure livability in neighbourhood streets, which will be the basis of our research model. Founded on this model, the chapter introduces hypotheses that assist answering the research questions.

### 2.1 Livability in built up environments

The share of literature about how livability is influenced by the built-up environment indicates a high interest in making cities more livable (Berke & Conroy, 2000; Deakin, 2001; Economist, 2011; Evans, 2002; Kochera, Straight, & Guterbock, 2005). The Economist Intelligence Unit for example describes how healthcare, education, urban design and open spaces are influential cornerstones in creating livable urban environments (Economist, 2011). Kochera et al (2005) describe how to create livable communities as suitable environments for aging according to these four cornerstones. These four can facilitate the setting of a community which provides a social environment that engages residents in civic and social life and enables personal independence. Since the 'Livable streets' project by Donald Appleyard in 1969 much literature about how livability is affected by specifically traffic in built up environments has come into existence (Bosselmann, Macdonald, & Kronmeyer, 1999; Cervero, 2002; de Vasconcellos, 2004). Research from a residents' perspective showed very interesting results (D. Appleyard et al., 1981). However, such empirical evidence about the relation between traffic and livability in a developing country context has yet to be obtained.

Cervero (2002) studies how the built up environment can influence modal choice. A compact, mixed-use, and walking friendly environment can influence the modes people choose. Bosselman, Macdonald & Kronmeyer (1999) study whether tree-lined boulevards that physically separate local and through traffic can improve livability of residents. They conclude that boulevards are successful in mitigating the adverse impacts of heavy traffic. However, boulevards require a significant road space, which is in emerging Asian cities such as Hanoi often not available. Hanoi is a compact, mixed-use city where mode choice is changing towards personal motorised vehicles, the walk friendly environment is likely to be diminishing. The following section discusses literature about livability in major Asian cities, given their developing context.

#### **Transport and livability in a developing context**

Considering transport in livable urban environments, literature from the developing world typically discusses ways to lower the dominance and growth of personal motorized transport (Shimazaki, Hokao, & Mohamed, 1994). Literature from the developed world however typically does the same, but by proposing modes as light rail and cycling (D. Appleyard, 1983). Thomson (1983) argues that urban transport is one of the most daunting problems faced by cities throughout the developing world. Cities experience heavy pollution and noise, while traffic is unsafe. According to Shimazaki (1994) major cities in developing countries in Asia are also afflicted with heavy transportation problems because of an excessive concentration of people.

Melia et al. (2011) argue that urban intensification as part of a smart growth strategy reduces overall car use, which is beneficial to the global environment, but evidence also suggests the effects will be less than proportional. Hence, at locations where intensification occurs, the concentration of traffic tends to raise, worsening local environmental conditions. The problem is this serious that to prevent local deterioration, Melia et al propose radical measures to constrain traffic generation within intensified areas. These are measures that are opposite of what happens today in the city of Hanoi, where motorised traffic rapidly grows. Gwilliam (2003) argues that urban transport solutions in developing

countries are more difficult to implement as these countries have weaker policies and institutional contexts than developed countries. Major Asian cities are intensifying and with their relative weak policies and institutions it might be difficult to constrain traffic generation in these cities, which is important to avoid local deterioration. Appleyard on the other hand investigated how traffic generation affected residents in a typical North-American city and inspired the whole world. This explorative study might therefore be symbolic for the sustainable traffic planning debate for South East Asian cities.

## 2.2 Appleyard's 1969 'Livable streets' project

No empirical research determining the impact of traffic volume in a middle-income country is discovered. For this research the Appleyard study will be revisited for the case study of Hanoi to explore how current traffic levels affects residents in there. This section discusses the work of Appleyard, whereas the next section applies his methodology to form a research model and hypotheses.

### Appleyard's contribution

De Vasconcellos (2004) argues that before Appleyard, the way that people use streets has been analysed by more traditional traffic engineering techniques. Appleyard was the first to assess the use of streets in a systematic way, not only in a technical and economic view but he also included the social and political one. With the call for a more sustainable transport system around the world, the work of Appleyard can be viewed as a step in the shift from predict and provide for road transport to one, which addresses sustainable mobility (Hull, 2008).

### The Theoretical model of the Ecology of the street

Appleyard developed his theoretical model of the 'Ecology of the street'. His model displayed many relations between the street environment, residents and travellers. Appleyard (1981) explored five livability indicators in interviews to measure livability in neighbourhoods. For a sixth indicator, mobility, which considers car use and ownership, he did not find significant differences across street types. The aspects of perceived livability or livability indicators are described below.

1. *Traffic hazard*  
Traffic hazard considers the danger of traffic, for instance by not following traffic regulations or excessive speeds.
2. *Stress, including noise and air pollution*  
Noise, air pollution, trash and vibrations may be stressful for people, both in the street and at home.
3. *Social interaction*  
Social interaction considers the friendliness of the street, and the number of friends and acquaintances people possess.
4. *Privacy and home territory*  
Privacy and home territory considers whether inhabitants feel they have sufficient privacy, and whether they have feelings of stewardship over their streets.
5. *Environmental awareness*  
Environmental awareness is about how well residents know their own street. Whether they are aware of their surroundings.

Appleyard and Lintell (1972) found all five livability indicators were found to correlate inversely with traffic volume. Danger, noise, vibrations, air pollution, inconvenience, and intrusions on activities and homelife increased with traffic volume. One of his key results shows the level of social interaction on three streets. Lines display that residents of the light traffic street had three times as many local friends and acquaintances compared to those on heavy traffic streets (Figure 5).



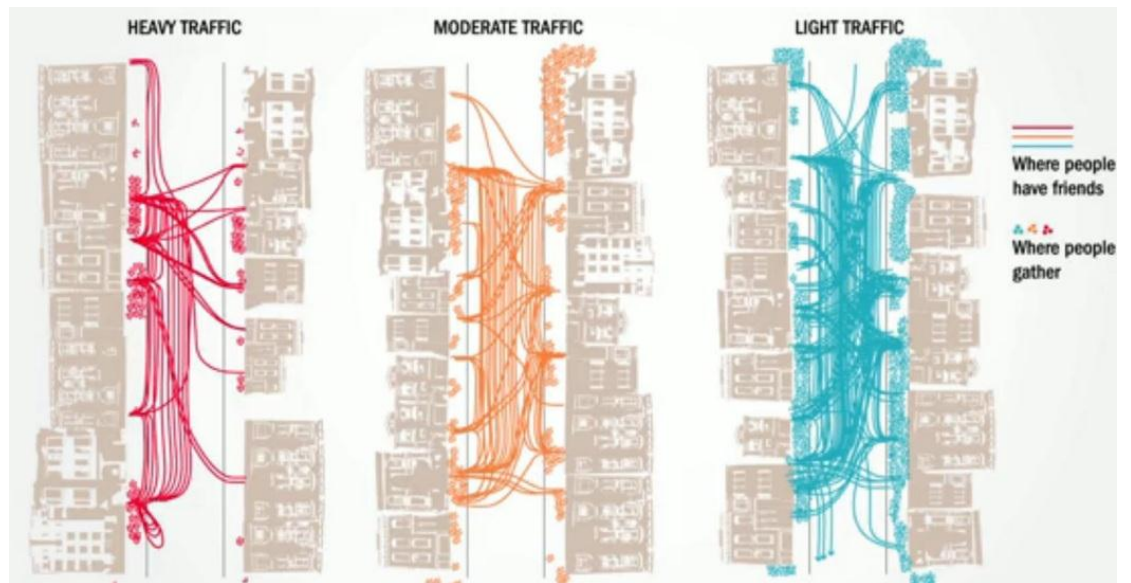


Figure 5. Social interaction on three streets in San Francisco (as cited in Press., 2010).

### Livability and traffic volume

Appleyard investigated how traffic volume influenced livability. Appleyard focused on traffic volume, but traffic also has the attributes speed, composition, direction and care that can influence street life. Livability is significant since it is important to people's wellbeing. Livability is all about quality of life and is defined by Okulicz-Kozaryn (2011) as the 'standard of living or general well-being of a population in an area'. It is also personal, while most people would not like to live in a street with busy traffic, some people would not mind or may actually like it. This last remark has to do with self-selection, which is discussed below.

### Residential self-selection

Environmental variables other than traffic volume might change when traffic volume alters. Self-selection is such a variable. Self-selection theory presumes that people's choices are based on variables in a model, but there might also exist variables that are unknown (van Wee, 2009). Interaction between these two types of variables can develop dependence of the model on unknown variables. The theory can be illustrated when considering the relation between traffic volume and livability. A likely outcome of this research is that residents along light traffic streets perceive a better livability than residents along heavy traffic streets. Yet, such an outcome does not clarify to what extent the perception of livability can be attributed to the traffic volume itself, as opposed to the prior self-selection of residents into a traffic volume that is consistent with their predispositions towards certain land use configurations. A model may include characteristics of the built environment, traffic volume, socio-demographic variables, but fail to include preferences for certain level of traffic volume. However, the people that prefer to live in a low traffic volume neighbourhood will, on average, live more often in these neighbourhoods. Ignoring this preference leads to an overestimation of the impact of the traffic volume on the importance of a light traffic street.

## 2.3 Research model and hypotheses

Appleyard's 'Ecology of the street' model serves as the basis for the research model used in this research. Two main elements distinguished from this model are traffic volume and livability. This research focuses on a one-directional impact of traffic volume on livability of residents. Traffic volume is the independent variable, and is expected to have a negative effect on the dependent variable, livability. However, environmental variables other than traffic volume might also effect livability indicators across street types. Besides residential self-selection, two environmental variables are identified: socio-demographic



characteristics of residents and street environment. The street environment is the physical street and neighbourhood characteristics. The goal is to isolate these environmental variables (see Figure 6).

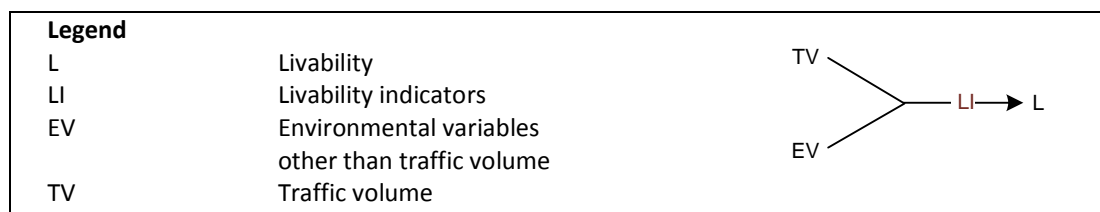


Figure 6. Research model showing the effects of traffic volume and other environmental variables on livability.

### Constructs or livability indicators

Of Appleyard’s six discussed livability indicators two are excluded from the present research, i.e. mobility, considering car use and ownership, and environmental awareness. The first is excluded as there were not enough questions selected in the selection process described in Appendix 7.3.3. The latter indicator is excluded to limit the scope of this current research and as the number of questions identifying environmental awareness in the original study was quite low, namely four. One of these questions is fairly complicated as respondents are asked to draw their street, while the level of detail of the street is meant to assess how well respondents knew their own street. This leaves us four livability indicators or constructs: (1) traffic hazard; (2) stress, including noise and air pollution; (3) social interaction; and (4) privacy and home territory. A construct encapsulates a livability indicator making use of nominal survey questions.

### Hypotheses

The research model is used to develop hypotheses for sub research question three, on comparison of streets. The first sub research question serves to find an appropriate study area. The second question investigates the livability level along survey streets, which is answered using the four distinguished livability indicators. To answer sub research question three the goal is to compare light and heavy traffic streets. With use of the livability indicators, hypotheses are developed that structure such a comparison. The central hypothesis is that a low traffic volume increases the livability of residents in Hanoi. Four sub hypotheses address each a livability indicator. One additional sub hypothesis compares whether environmental variables other than traffic volume change across street types. Table 1 shows the hypotheses of the present research and the analyses method per hypothesis.

Hypothesis	Research design	Variables	Status of variables	Analyses method and result presentation	Statistical tests
<b>Central hypothesis</b> A low <i>traffic volume</i> increases the <i>livability</i> of residents in Hanoi.	Field experiment	• Traffic volume • Livability	• Independent • Dependent	Figures / numbers	T-test Cronbach’s $\alpha$
<b>Sub hypotheses</b> A low <i>traffic volume</i> reduces the perception of <i>traffic hazard</i> of residents in Hanoi.	Field experiment	• Traffic volume • Traffic hazard	• Independent • Dependent	Figures / numbers	T-test Cronbach’s $\alpha$
A low <i>traffic volume</i> reduces the <i>stress level</i> of residents in Hanoi.	Field experiment	• Traffic volume • Stress	• Independent • Dependent	Figures / numbers	T-test Cronbach’s $\alpha$
A low <i>traffic volume</i> increases <i>social interaction</i> of residents in Hanoi.	Field experiment	• Traffic volume • Social interaction	• Independent • Dependent	Figures / numbers	T-test Cronbach’s $\alpha$
A low <i>traffic volume</i> increases the <i>privacy and home territory</i> of residents in Hanoi.	Field experiment	• Traffic volume • Privacy and home territory	• Independent • Dependent	Figures / numbers	T-test Cronbach’s $\alpha$
<i>Environmental variables other than traffic volume</i> remain constant when <i>traffic volume</i> is altered.	Field experiment	• Traffic volume • Environmental variables other than traffic volume	• Independent • Dependent	Numbers	T-test

Table 1. Hypotheses and analyses method per hypothesis.

### 3 Methodology

The previous chapter made clear that traffic volumes and livability are the key variables of this research. To determine the impact of traffic volume on livability of residents along residential streets in Hanoi a study needs to be set up into more detail. The chapter prepares a research strategy, study area and three research instruments for the gathering of data. Therefore, It answers the first sub research question:

#### 1.1 *Which residential streets can be distinguished with different levels of traffic volume, but all other physical variables the same?*

Selecting streets with similar appearances, yet different traffic volumes is vital for the study. First a method is distinguished to find appropriate streets, then the street selection process follows after which four streets are selected. Furthermore the chapter introduces three research instruments: a (1) questionnaire survey, (2) in-depth interviews and (3) inventory (observations) of the physical environment. Lastly, the chapter describes the sample and target population, and the research extend. With this chapter the set-up of the research is ready, to allow inferences and analyses of the results in the next chapter.

#### 3.1 Research strategy

Given the research model, particularly the hypotheses and the main objective to determine the impact of traffic volume on livability of residents Hanoi in a field experiment is a suitable strategy. In a field experiment there are (minimal) two similar groups, one group is exposed to an 'intervention' and the other is the control group. The field experiment uses differences encountered in the real life to create the 'intervention' and allows the usage of a survey and a large number of respondents and can be used for quantitative analyses. According to this theory residents along light traffic streets form the control group and residents along heavy traffic street the intervention.

#### 3.2 Street selection

Which residential streets can be distinguished with different levels of traffic volume, but all other physical variables the same in Hanoi? To come to an answer to this question the street selection methodology and selection process are first discussed. The methodology will describe how streets were selected theoretically whereas the street selection process denotes how it went in practise.

##### **Street selection methodology**

Appleyard aimed to find streets that are "identical in appearance, yet different in their volumes of traffic" (Appleyard, 1981, p. 15). The goal here is therefore also to find three to four streets, analogue to Appleyard's pilot study. Limiting the study to four streets keeps the study practical, whereas two streets would make the research highly sensitive to specific circumstances at one of these streets.

To have highly identical streets, the streets are chosen based on their similarities in: street environment, traffic characteristics, residents' characteristics and the neighbourhood characteristics. Table 2 contains an overview of different characteristics that supposed to be relevant for each of these four criteria. In practise, the selection of streets can only be based on a small set of variables, therefore the focus for the street selection is on the consistency of the following characteristics at the various streets: road width, sidewalk width, housing types, the presence of trees and land use diversity. In addition, the traffic volume is supposed to differ significantly at selected streets, whereas the aim is to find all streets in the same neighbourhood.




Criteria	Street environment	Residential characteristics	Traffic characteristics	Neighbourhood characteristics
Characteristics	<i>Road width</i> <i>Sidewalk width</i> <i>Houses</i> <i>Trees</i> <i>Mixed land-use</i> <i>Setback</i> <i>Moving lanes</i> <i>Lane width</i> <i>Surface</i> <i>Lighting</i> <i>Pedestrian area</i> <i>Bus stops</i> <i>Parking area</i>	Median income Ethnicity Gender Age Children Occupancy Education Home ownership Marital status	<i>Traffic volume</i> <i>Traffic composition</i> <i>Direction (two-way, one-way)</i>	<i>Distance to city centre</i> <i>Distance to food stores</i> <i>Within or outside urban core</i>

\*The selection of streets was based on the italic characteristics

**Table 2.** Street selection criteria's and characteristics

### Street selection process

Finding streets with a relatively consistent sidewalk width, housing type and level of greenery in one neighbourhood appeared relatively simple. However, for most of the potential study areas, an increase in traffic volume is accompanied by an increasing roadway width and changing land-use diversity. At the potential fieldwork locations with little traffic, space is mostly occupied with terraces, parked vehicles and temporary food stalls, whereas at heavy traffic street a lot of space is generally allocated for the traffic volume. The researcher visited around 15 potential study areas for inspection. Two study areas contained streets that showed limited change in roadway width while traffic volume was increasing. The different sections of Phuong Mai Street, and Lo Duc Street and Le Ngoc Han Street (see Table 3).

	Phuong Mai Street	Le Ngoc Han Street	Lo Duc Street
			
Remarks	There are a few hospitals in the heavy traffic Phuong Mai Street section.	Traffic in Lo Duc Street is one-directional, all other streets have two directional traffic.	
Traffic volume <sup>a</sup>	Light	Heavy	Very heavy
Number of trees	Many	Some	Some
land use diversity	High	High	High
roadway width	12 m	12.5 m	14 m
Sidewalk width	1 m	1 m	2 m
housing types	High rise complexes, terraced houses	High rise complexes, communistic housing, terraced houses	High rise complexes

<sup>a</sup> Estimated by researcher

**Table 3.** Summary of the environment of three streets as potential survey areas. Phuong Mai Street, Le Ngoc Han Street and Lo Duc Street.

The final study area (Figure 2) is carefully selected in a focus group discussion that included the researcher, a local Vietnamese urban planner and a local urban development specialist<sup>1</sup>. Phuong Mai Street is selected as the most promising study area (see Figure 7). The first half of Phuong Mai Street has a heavy traffic volume, whereas the rest of the street has a light traffic volume. Most of the traffic at Phuong Mai Street travels to or from a side street half way Phuong Mai Street. As Phuong Mai Street is one street, which is physically quite similar, but has high differences in traffic volume, it is a valuable

<sup>1</sup> Focus group:

Dr. ir. Stephanie Geertman, living in Hanoi for 10+ years, has a PhD in Architecture and Urban Planning  
 Nguyen Ngoc Quang, MSc, living in Hanoi for 30+ years, has a MSc in Urban Planning  
 Peter Sanders, BSc, has a BSc in Civil Engineering & Management

street for the research. Then is decided to choose suitable streets near Phuong Mai Street to keep the fieldwork practical and to have all streets in the same neighbourhood.

A few alleys and lanes near Phuong Mai Street that have a very low traffic volume and the heavy traffic but quite small Bach Mai Street follow. The alleys and lanes are special as they are expected to have very little traffic. Other alleys around Phuong Mai Street have different housing types as Phuong Mai Street or are expected to have a higher traffic volume. The heavy traffic Pham Ngoc Thach Street seemed also a suitable nearby heavy traffic street. Pham Ngoc Thach is, however, wider, has some highly modern high rise complexes and a physical central reservation. At first, permission for the survey was denied at Bach Mai Street by the local ward authority, but at another section of Bach Mai Street the survey could take place. The response rate to the survey at the Phuong Mai Side lanes appeared to be quite low. To reach the goal survey sample, two extra lanes were added to this group of lanes and alleys. The next section will describe the selected streets.

### 3.3 Study area: Four streets in Hanoi



Figure 7. Street map and photos of study area. Bach Mai and Phuong Mai Street group (Google Earth, 2012).

The different street sections of Phuong Mai Street and Bach Mai Street are selected as the study area. The different sections of these streets are labelled heavy and light traffic according to their respective peak hour traffic volume, which varies from 224 to 2,047 personal car equivalents per hour.

### Description of streets

The focus group selected four groups of street sections. Two selected street sections are the light and heavy traffic street sections of Phuong Mai Street (see Figure 7). The third street is a section of Bach Mai Street, a nearby heavy traffic street. An area with a few light side lanes of Phuong Mai Street serves as the final group of street sections. In Hanoi, there are many side lanes and alleys, as the city is organically built. A side lane is called 'Ngo' and an 'alley' Ngach. The third group of street sections consists of Phuong Mai side lanes and alleys, and consists of Phuong Mai Ngach 4/14, Phuong Mai Ngach 4/22, Phuong Mai Ngach 4/26, Phuong Mai Ngo 2 and Phuong Mai Ngo 167. In the rest of this research, I simplify these four groups of street sections to just two light and two heavy traffic streets. According to the focus group, the streets are also representative for residential streets in Hanoi, as the streets are no provincial or ring roads but organically shaped streets with highly mixed functions.

### Physical differences between streets

Characteristics	Phuong Mai side lanes	Phuong Mai Street (light)	Phuong Mai Street (Heavy)	Bach Mai Street
Peak hour volume (PCE/hour)	224	362	1,866	2,047
Peak hour volume (vehicles/hour)	885	1,501	7,354	8,383
Roadway width (m)	4	12	12.5	12.5
Footpath width at one side (m)	1	1	1	1.5
Land-use diversity <sup>a</sup>	Some mix	A lot of mix	A lot of mix	A lot of mix
Land-uses presence in street <sup>b</sup> :				
Houses	High	High	High	High
Office	None	None	High	Some
Public / Government	None	None	None	None
Schools	None	None	None	None
Shops	High	High	High	High
Restaurant / café	Some	High	High	High
Entertainment	None	None	Some	None
Park / playground	None	None	None	None
Obstructions blocking the footpath	Motorbikes, Trash cans, pillars, cables, trees and vendors	Motorbikes, shop goods, vendors, pillars, cables and trees.	Motorbikes, construction rubbish, entry cuts for car exit, shop goods, vendors, pillars, cables and trees.	Motorbikes, construction rubbish, entry cuts for car exit, shop goods, vendors, pillars, cables and trees.
Leaving the footpath because of obstructions	Could not walk on path	Could not walk on path	2 to 6 times	1 to 3 times
Number of broken footpath sections <sup>c</sup>	Many	Some	Some	Some
Number of broken roadway sections <sup>c</sup>	Few	Very few	Few	Very few
Trees shading in the walking area? <sup>d</sup>	Some	Many	Some	Very few
Noise pollution	A little	Some	A lot	A lot
Number of street segments people greeting and talk to one another	Some	All	Some	All
Number of street segments with aggressive drivers	None	Some	All	All

<sup>a</sup> Definitions: No Mix = the area is only one type of use; A little mix = the area is 75% of one use and has a mix of other uses; some mix = the area has 50% of one use and has a mix of other uses or 50% of another use; A lot of mix = the area has lots of variety of uses and no one use makes up more than 40% (HealthBridge Canada, 2012).

<sup>b</sup> Definitions: none = no access to use in segment; some = minimal 1 access to use in measured segments; high = minimal 1 access to use at every measured segment (HealthBridge Canada, 2012).

<sup>c</sup> Definitions: Not complete = a footpath/roadway is not complete if it ends or has gaps within the segment, this does not refer to barriers that may be created by obstructions; complete one side = a footpath/roadway on only one side of the road is complete if it does not have any breaks within the segment and goes from one end of the segment to the other; complete both sides = if the footpaths/roadways on both sides of the road do not have any breaks or gaps and goes from one end of the segment to another (HealthBridge Canada, 2012).

<sup>d</sup> Definitions: none or very few: the path is not shaded by any trees (or only one tree) along the segment (the footpath is less than 25% is covered); some: the path is covered between 25 and 75% of the way; many/Dense: more than 75% of the path is shaded by trees.

**Table 4.** Summary of the physical environment of selected streets.

### Environmental differences between streets

The heavy traffic streets felt lively, crowded and chaotic with big advertisements, many electricity wires and a lot of noise, smells and people. The light traffic streets have cafés with terraces, many motorcycles are parked, children play and it feels quiet. The light traffic Phuong Mai side lanes had a more homogeneous land use and were smaller than the other streets; the road width of was respectively 6 meter compared to 13 meter. Both heavy traffic streets had a higher share of offices (see Table 4).

## 3.4 Research question 1.1

### 1.1 Which residential streets can be distinguished with different levels of traffic volume, but all other physical variables the same in Hanoi?

Referring to the first research question the observations in the chapter show that between these four carefully selected streets there are still physical differences (see Table 4). However, especially the two sections of Phuong Mai Street are highly similar and valuable for the research.

## 3.5 Research instruments

Both Appleyard's "Livable streets" study and this research use a survey as the main research instrument. In-depth interviews, observations of the physical environment and traffic counts serve to gain a better understanding of the survey and to acquire knowledge of the physical environment. The different instruments are discussed below and depicted in the appendices. Data was collected in June 2012 during normal weeks, no holidays. All interviewing were conducted between 15:00 PM 21:00 PM on weekdays, and all day on the weekends from 9:00 to 21:00.

### The survey

In his pilot study, Appleyard begins his study with explorative research by conducting door-to-door interviews with open-ended questions. Afterwards he developed an improved research instrument in more detail by focusing on a set of nominal scaled questions (D. L. Appleyard, M., 1972). This improved instrument is adjusted in our research for the Hanoi context. Questions were newly created, evaluated and selected by the researcher in cooperation with two local urban planners. Finally, all questions were selected on their practicality, objectiveness, value in the original Appleyard study, expected value in Hanoi and expected explanatory value of the corresponding livability indicator (appendix 7.3.3). The survey was tested with three respondents and reviewed by a panel of local and international experts<sup>2</sup>. With their advice it is decided up on the final set of questions. One remarkable question encouraged people to draw a simple diagram on a specially prepared map of their street. This question indicates how many residents, respondents know on their street.

This research had a sample of 180 surveys with 122 questions in four streets. The interview time was approximately 25 minutes and the age-sex distribution targeted close to the population parameters. In selecting households, the aim was to interview all households in a certain section of the street until the target was reached. Trained interviewers were introduced by the chief of the street, and, if nobody was at home, they went back later or the following day. Like Appleyard, the survey was introduced as an instrument for neighbourhood improvement. The head of the street contributed to the access to households. This head often went through his or her street to announce the questionnaire to households. Although chances are small, the social network of the leader of the street may have

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<sup>2</sup> Panel of experts:

Asst. Prof. Mark Zuidgeest, Assistant Professor Urban Transport

Dr. ir. Stephanie Geertman, living in Hanoi for 10+ years, has a PhD in Architecture and Urban Planning

Nguyen Ngoc Quang, MSc, living in Hanoi for 30+ years, has a MSc in Urban Planning

Thi Huong Giang, BSc, living in Hanoi for 30+ years, has a BSc in Architecture

Kristie Daniel, MPH, is the Livable Cities Program Director of HealthBridge



influenced our sample. Furthermore, richer households appeared less eager to participate. The survey research method, form and question selection are added in appendix 7.3.

#### Lay-out of a Multi criteria analysis (MCA)

The answers from the door-to-door questionnaires are aggregated to four constructs. The research outlined the corresponding livability indicators. The constructs are calculated with the use of a multi-criteria analysis (MCA), which combines the various variables in each livability indicator into one meaningful construct. As such, MCA gives a simple, straightforward and balanced view of the results of the survey. However, it is sometimes considered as a subjective tool as the weighting and selection of questions can influence results. The variables for each construct follow from the question selections discussed before. It is decided to use uniform weights to each of the variables in the MCA calculation. Another limitation is that when two questions highly correlate because they cover the same aspect of a livability indicator, this aspect will be overrepresented in the construct. This is decided upon to simplify the calculation process. The multi-criteria analysis is just one of results of the research, next to the description of results of the survey questions and the in-depth interviews.

The MCA combines the scores of answers to the different survey questions to calculate constructs. The construct is calculated for each respondent. To minimise data quality loss, the aggregating method adds a different amount of points, to questions with different scales, using the system indicated between brackets: a 5-point likert scale (0 to 4), 3-point likert scale (0 to 2), or dichotomous (0 to 1). I convert continuous values to a 5-point likert scale. The question value ( $v$ ) is the number of points corresponding to the respondents answer; it is the number before the answer of the question in the survey minus one. For some questions the scale is mirrored to correspond with the construct. The formula below displays the first step of the MCA calculation (see Figure 8).

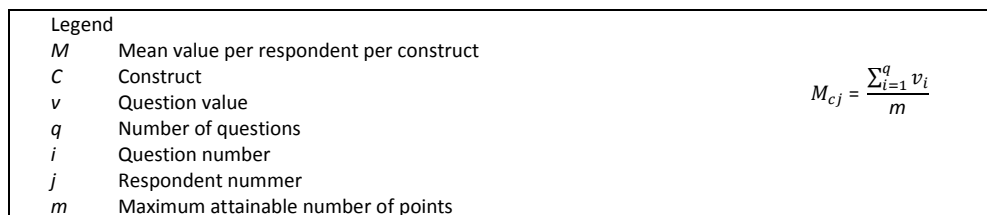


Figure 8. Formula for multi criteria analysis.

To compare significant differences between light and heavy traffic streets for each livability indicator, a T-Test for two independent samples was used for the light and heavy traffic street sample. The T-tests group the mean value per respondent per construct described above, per street type. It is assumed that groups are unrelated and normally distributed.

#### In-depth interviews

Participants in the questionnaire survey were asked whether they would mind to be approached for an in-depth interview. From this sample and in conjunction with the head of the street, three in-depth interviews were done in each of the four streets. The interview took about 20 minutes. The guidelines that structured the in-depth and summaries of the four interviews are in appendix 7.2.

#### Observations of the physical environment

The observations determine street characteristics, pedestrian activity and traffic activity. The method for the street inventory survey has been adapted from HealthBridge Canada (2011)<sup>3</sup>. For the present

<sup>3</sup> HealthBridge developed this survey to generate a clearer picture of the actual problems faced by pedestrians in Dhaka and to identify and document the specific challenges that they confront on a regular basis. HealthBridge based the survey on the Analytic Audit Tool developed by Saint Louis University and the Pedestrian Environment Data Scan tool developed by the National Center for Smart Growth of the University of Maryland.

research, a few extra questions are added to the observation survey to obtain details about roadway quality. In addition, traffic counts measured the peak hour traffic volume.

The “Manual Observation Survey” of HealthBridge described the methodology of the street inventory. It divides streets in segments and each street segment is measured. For the present research, only two to three street segments are measured per street due to time constrains. These segments are randomly chosen. The observation survey is extended with extra questions considering roadway quality for this research and shown in appendix 7.1, which also contains the Manual Observation Survey. The collected data is analysed with T-tests to determine significant differences across street types. Observations were conducted at weekdays between 10:00 and 14:00.

Traffic counts measured peak hour traffic volume and traffic mix. For calculating the personal car equivalent (PCE), 5 motorcycles or 5 bicycles are equivalent to 1 car and a bus or truck is equivalent to 2.5 car, similar to the methodology of ALMEC in Vietnam (ALMEC Corporation, 2005). Measurements were between 17:00 and 18:00.

### 3.6 Participants

With the study area and the research instruments ready, the sample size was determined for each instrument. Apart from calculating sample sizes, the target sample size is also compared with the obtained sample size. Finally, the characteristics of our sample population are described and compared with the Hanoi population.

#### Sample size determination for survey

The goal of the study is to determine differences in livability across street types. Therefore, a suitable sample size is determined with the formulas of Rosner (2000) for comparing two means in cross-sectional studies (see Figure 9).

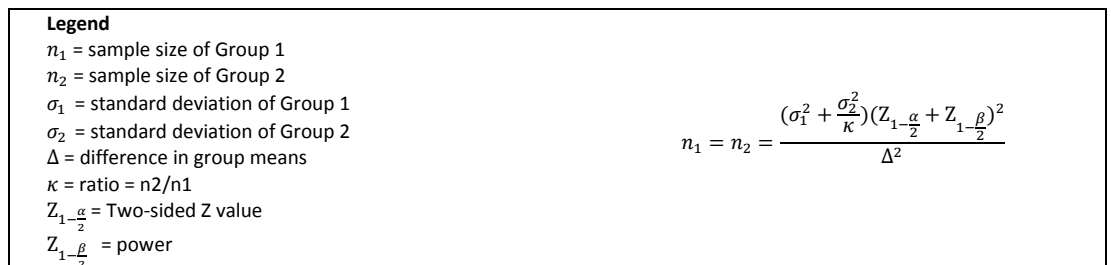


Figure 9. Formula for sample size determination.

To determine a suitable sample size, a hypothetical question with a 5-point likert scale is used as example. Assumed is that the Group 1 mean is 2.0 and the Group 2 mean is 2.5, a ratio between sample size (Group 1 / Group 2) is 1.0,  $\sigma_1 = \sigma_2$  is 1.0, a power of 80% and a 2-sided confidence interval of 95%. A 2-sided confidence interval of 95% and power of 80% are acceptable values in the majority of studies according to Bernard Rosner. Z is 1.96 for 95% confidence interval. According to these values an appropriate sample size would be 126 participants to find significant differences between the two groups.

Apleyard interviewed 36 households in three different streets for about one hour in his pilot study. In consultation with HealthBridge Canada and supervisors of this thesis it is decided to expand the sample size to 288, to increase the scientific significance of this research and the use of the research for advocacy. Another benefit of increasing the sample size is that variables interfering with the experiment have less chance to influence the experiment as the results will be highly significant.



### Sample sizes of research instruments

The target and obtained sample sizes show some dissimilarities for some research instruments (see Table 5). The target sample size has been determined before the data collection took place, whereas afterwards the obtained sample sizes are calculated. The obtained sample size of the survey is significantly lower than intended. The deficit follows from the limited availability of suitable households in the selected streets and residents declining interviews. Households are only suitable for the research when facing the street and when the entrance to the household is via a door on the street. The researcher counted the number of suitable households on each street, which did not result in a sufficient sample of households at each street.

One survey question asked respondents to indicate friends on a street map. This question was included less often in the survey as maps needed to be prepared, the quality of the outcome of the question was not yet ensured with the three test surveys, and as they were expected to be time-consuming during the fieldwork and analyses. During the execution of the fieldwork it was not clear how often the drawing questions were executed at each street, therefore the obtained number is higher than the intended number. The target was to conduct three in-depth interviews at streets, to have various opinions per street. One of the interviews is not understandable due to street noise. The goal was to observe two street segments at each street, an extra road segment has been observed to observe the Phuong Mai side lanes more closely.

Research instruments	Target sample size	Obtained sample size
Survey	288	180
Indicating friends on a street map question	48	62
In-depth interviews	12	11
Number of observed road segments	8	9
Traffic counts	4	4

**Table 5.** Target sample size and obtained sample size per research instrument

### Resident characteristics of selected streets and Hanoi population

Table 6 shows the population size, average age and average income of the survey sample and Hanoi population.

Characteristics	Hanoi	Sample data	Phuong Mai Side streets	Light traffic Phuong Mai Street	Heavy traffic Phuong Mai Street	Bach Mai Street
Average income (million VND)	3.5 <sup>a</sup>	2.6 <sup>b</sup>	2.9 <sup>b</sup>	2.2 <sup>b</sup>	3.3 <sup>b</sup>	2.3 <sup>b</sup>
Number	6.4 million <sup>c</sup>	180	43	38	31	68
Family Composition						
% under 10	13 <sup>d</sup>	15	15	17	16	13
% 10-19	15 <sup>d</sup>	9	8	8	10	11
% 20-39	34 <sup>d</sup>	32	29	35	38	31
% 40-59	24 <sup>d</sup>	25	20	22	21	31
% 60 or older	11 <sup>d</sup>	19	28	17	15	15
% of male population	50 <sup>d</sup>	37	44	40	32	32
% of female population	50 <sup>d</sup>	63	56	60	68	68
% Renting a house	<sup>e</sup>	7.8	2.3	5.3	23	5.9
Years in neighbourhood	<sup>e</sup>	19	16	23	13	24
Years in house	<sup>e</sup>	18	14	22	11	23
% businessman, or governmental officer	<sup>e</sup>	45	51	58	52	42
% attended college, business-, technical school or university	<sup>e</sup>	55	84	63	55	32

<sup>a</sup> (JICA, 2007)

<sup>b</sup> Total family income/family size

<sup>c</sup> (PPJ, 2011)

<sup>d</sup> Was calculated from the age-sex pyramid of (Gubry, 2010)

<sup>e</sup> Unknown

**Table 6.** Summary of resident characteristics of selected streets and Hanoi population.

By income level, the streets seem relatively homogeneous. Contrasts, however, occurred in occupation and education level. From these observations especially the light traffic Phuong Mai, side lanes seemed to have a higher than average share of wealthy people, businessmen and governmental officers and well educated residents. The other light traffic street did not appear to be wealthier than at the heavy traffic streets. The income level of the sample data is somewhat low compared to the Hanoi average. The survey area is within Hanoi's urban core and the Hanoi average is from 2007 or earlier, whereas the sample data is from 2012. Such a difference may be the consequence of the usage of multiple data collection methods. Further, family composition has an underrepresentation of residents between 10 and 19 and an overrepresentation of residents of 60 and older in the sample data. Finally, the majority of interviewees is women, and it is remarkable that an exceptional high percentage of residents rent a house on the heavy traffic Phuong Mai Street.

### **Representativeness of the study for Hanoi**

The study aims to determine the impact of traffic volume on livability in Hanoi. This section aims to identify whether the results can be generalised for the whole of Hanoi, as the study area of the research is limited to four streets.

#### *Necessary sample size for generalisation*

According to Kotrlik & Higgins (2001) a sample size around 400 residents would be representative given a population of 6.4 million, a confidence level of .05, and a population proportion assumed to be .50. With a sample of 180 residents, .0028 % of the Hanoi population has been interviewed. The population proportion is a part of a population with a particular attribute, expressed as a fraction of the whole population. An attribute can be whether they perceive stress or not. With a population proportion of 98%, 98% of the respondents select the same answer and there is not much room for error. By assuming a population proportion of .50, the necessary sample size will be large in order to identify statistically significant differences between the two groups. The experimental group of the study consists of 99 respondents along heavy traffic streets representing people living along heavy traffic streets in Hanoi. The other 81 respondents represent people living at light traffic streets. However, the number of residential light and heavy traffic streets in Hanoi is unknown and to represent both light traffic and heavy traffic populations, the sample size will need to be about twice as large. With the formula of Kotrlik & Higgins (2001) each population group is represented by its own sample. Furthermore, the sample frame is known, but the sample is not chosen at random from the sampling frame. The sample is randomly chosen from a few carefully selected streets in Hanoi. This means that the sample is unlikely to be representative for the population being studied.

#### *Concluding remarks*

Making generalizations from the sample for the Hanoi population is assessed as explorative research given the unknown differences between the sample and Hanoi in socio-economic characteristics, the limited sample size and non-random sampling. The representative could improve by correcting for the different sample population age groups, increasing the sample size and incorporating more streets.

## 4 Study Results

This chapter analyses the results of the study and makes some inferences, especially related to the two sub-research questions:

- 1.2 *What is the livability of residents along streets with different traffic volumes?*
- 1.3 *What can be learned from comparing livability of residents along streets with different traffic volumes in Hanoi?*

Before answering these two questions the data quality of the collected data will be assessed, particularly the reliability and validity of the survey results. Then is investigated whether other variables than traffic volume influence livability. The chapter investigates residential self-selection and compares the similarity of the four survey streets to unravel differences in socio-demographic characteristics and the street environment. To answer sub-research question 1.2 the constructs give a score to each livability indicator for both light and heavy traffic streets. The responses of the residents are summarised per livability indicator and show how they value livability in the four selected streets. Quotes from the in-depth interviews illustrate residents' opinions. Earlier, the Theoretical framework developed hypotheses for determining significant differences in livability between heavy and light traffic streets using Appleyard's theory (see Table 1). The answer to the latter sub-research question follows from testing these hypotheses. The information gathered per livability indicator with these questions and hypotheses will be interpreted in the next chapter on conclusions and recommendations.

### 4.1 Data quality

Before making any inferences, the data quality needs to be reviewed. The following section elaborates on the validity, reliability and parametric level of the survey data.

#### Parametric survey data

Differences between light and heavy traffic streets are identified by testing the hypotheses with a T-test. To be able to apply Pearson T-tests, the data has to be parametric. One requirement for parametric data is that the sampling distribution is normally divided. The central limit theorem states that the sampling distribution is normal for sample sizes from 40 cases. Further, it is assumed that the type of data is interval data and that scores of different participants are independent from each other. As many residents live in the same street, the latter assumption may influence the representativeness of the research for Hanoi. In addition, the survey data contains four addresses where two interviews have been conducted at the same address, two at the light traffic Phuong Mai Street, one at the heavy traffic Phuong Mai Street and the final one at Bach Mai Street. Assuming that the addresses are recorded correctly, it seems plausible that 8 out of 180 respondents are not from eight different households. As the persons are from the same household, they may have corresponding scores in the survey. However, as these 8 persons represent less than 5% of the sample, the risk that scores of different respondents are not independent from each other is expected to be negligible.

The Shapiro-Wilk test for normality, frequency distributions of the different questions and Levene's test for homogeneity of variance indicate a few minor errors. Question 13 is removed from the analysis as it seems to be misunderstood by respondents. The question goes as follows: "some people feel that also the sidewalk or the street feels as a part of their home. Which statement on this card best describes where you feel your home extends?". Based on the strangely shaped frequency distribution of resident responses in the answer categories, the high abstract level of the question, and the different responses from the in-depth interviews considering this question, the question is assessed not fit for further analyses.

### Reliability of constructs

Reliability means that a survey should consistently reflect the construct that it is measuring (Field, 2009). Cronbach's alpha determines the internal consistency between a set of questions belonging to a construct. The internal consistency of traffic hazard and social interaction is acceptable. Stress, including noise and air pollution, and privacy and home territory, were found to be respectively highly and poorly reliable (see Table 7). Cronbach's Alpha tends to be lower when the number of questions is lower. The poor internal consistency for privacy and home territory may be low, as the number of questions for the construct is rather low. Still, it is like that the survey measured privacy and home territory poorly consistently.

Indicators of livability	Number of survey questions	Internal consistency Cronbach's Alpha	Pearson's correlation "How do you all-in-all feel about living in this street?" (answers vary from very happy to very unhappy)
Traffic hazard	7	.67	.28
Stress, including noise and air pollution	19	.85	.42
Social interaction	20	.66	-.05
Privacy and home territory	5	.50	-.28

Table 7. Internal consistency and validation of constructs.

### Validity of constructs

The following paragraph elaborates on the validity of the survey, which is whether the survey actually measures what it is set to measure. All indicators of livability were significantly correlated with our question about "How do you all-in-all feel about living in this street?",  $p < .01$ , apart for social interaction (see Table 7). This question serves to validate whether the different constructs indicators actually measure livability. The social interaction construct had no significant relation with "How do you all-in-all feel about living in this street?",  $r = -.05$ ,  $p > .05$ .

According to the Appleyard literature social interaction is an aspect to measure livability, but this is not confirmed with this validation. It is unclear whether social interaction questions determines livability in Hanoi. Other variables than social interaction might determine the "feeling about living on this street" in Hanoi, it could also be that people misunderstood questions about social interaction. The questions asked are similar to Appleyard's improved survey tool. They are assessed as suitable in Hanoi in the question selection process (see Section 7.3.3). However, apart from the nominal survey questions, the in-depth interviews as well as the question where respondents indicate friends on a street map point out similar results. Of the survey respondents 33% valued 'sociable, friendly people' as 'very important' in deciding on what kind of street they wanted to live (see Table 8). Therefore, the construct is still assessed as likely to be valid for livability in Vietnam. Given the theoretical sound structure and similarity to other indicators than the nominal survey questions, the validity of the construct is valued as acceptable.

## 4.2 Environmental variables other than traffic flow influencing livability

Environmental variables other than traffic flow might influence the livability indicators in the experiment, which may prevent drawing firm conclusions. Therefore, the section tests the following hypotheses:

*Environmental variables other than traffic volume stay constant when traffic volume is altered.*

If they are not constant when traffic volume is altered the variables are not necessarily a nuisance. Possibly, the environmental variable is a consequence of traffic volume. Three assumptions considering the street environment, socio-demographic characteristics of residents and residential self-selection will be analysed to test this hypothesis:

- a) *The street environment remains constant when traffic volume is altered*
- b) *Socio-demographic characteristics of residents remain constant when traffic volume is altered*
- c) *Residential self-selection remains constant when traffic volume is altered*

**Assumption A: The street environment remains constant when traffic volume is altered**

Assumption A was tested by comparing the physical environment across street types. The observations of the physical environment gathered data of the environment of surveyed streets. The observations focused on the following categories: land use diversity, safety, sidewalk/footpath availability and quality, roadway quality, facilities for the disabled, availability of pedestrian amenities, and other issues, such as noise and availability of parking. Of 32 questions three showed significant differences across street types (see Table 4). The heavy traffic streets had a significantly higher share of offices and a higher road width in the street than the light traffic streets. Furthermore, at the heavy traffic streets you did not need to leave the footpath because of the obstructions as often as at the light traffic streets.

These differences in the street environment across street types might influence the experiment. Offices close at night, bring liveliness to the street in daytime, and could therefore influence social interaction. Second, it is unsafe when pedestrians have to leave the footpath because of obstructions, which influences the experience of traffic hazard. This occurred mostly at both light traffic streets, where it was less dangerous to walk on the road. It might be safer to walk on road of a light traffic street, than having to leave the footpath a few times on a heavy traffic street. This also follows from the survey results, as walking conditions of heavy traffic street were rated worse than those at light traffic streets. The road width of the Phuong Mai side lanes is different from the other streets. Thus, differences in livability between the two light traffic streets might be attributed to road width. The results show a few cases that differed for Phuong Mai side lanes compared to the other streets, for instance the frequency of exercising and motorcycle washing. It is unlikely that these differences are attributed to road width.

*Concluding remarks on assumption A*

Out of 32 street environment questions, three were different across street types. Logically it follows that the street environment changes somewhat when traffic volume is altered in the survey area. Most physical differences across street types can be isolated and therefore the impact of these is unlikely to interfere with the relation between traffic flow and livability. The share of office space is an exception to this. However, as land use diversity is high at both the light and heavy traffic section of Phuong Mai Street, no severe impact is to be expected.

**Assumption B: Socio-demographic characteristics of residents remain constant when traffic volume is altered**

Assumption B was tested by comparing preferences of residents across street types and assessing the socio-economic characteristics of the survey population as described in the study area section.

*Socio-economic characteristics of the survey area population*

Income level and years in the house are relatively homogeneous across street types (see Table 6). Contrasts, however, occurred in occupation and education level. Especially the differences in education level are considerable. Closer analyses shows that the education level does not significantly correlate with any of the livability indicators apart from privacy and sense of territory. In sum the education level is different across street types which may influence the results of privacy and home territory.

*Preferences of residents*

Nineteen survey questions asked residents in what kind of street they preferred to live (see Table 8). Four questions differed significantly across street types: pleasant view, cost of housing, schools close to home and prestige of area. Having schools close to home is more important for people at light traffic

streets, whereas cost of housing, prestige of area and a pleasant view is more important to people at heavy traffic streets. In sum, there are a few differences between the preferences of residents across street types.

What is important?  
 “Below is a list of some things that are important to different people in deciding what street they want to live on in the city. For each one, please check how important or unimportant it is to you personally to have this.”  
 (Only “Very important” responses recorded)

Description	Total responses (%)	Phuong Mai side lanes (%)	Phuong Mai Street (light) (%)	Phuong Mai Street (Heavy) (%)	Bach Mai Street (%)
Safe and secure from crime	57	56	63	68	50
Safe and secure from traffic	53	56	53	62	46
Clean, unlettered	50	40	55	58	50
Minimal air pollution	49	47	47	61	47
Greenery: trees, grass and plantings along the street	40	40	40	45	38
Peaceful and quiet, not noisy	35	33	32	32	39
Sociable, friendly people	33	35	37	39	28
Prestige of area	33	35	34	32	31
Good for children to play	33	38	24	39	31
Cost of housing	30	18	26	32	38
Schools close to home	29	30	34	19	29
Convenient to work	23	24	18	26	25
Space for sport and leisure activities on pedestrian area i.e. badminton, chatting	21	21	24	16	22
Good walking conditions	21	14	18	19	27
Parks and recreational facilities nearby	19	12	24	7	27
Convenient to downtown	18	16	21	13	21
Privacy	17	19	11	16	19
Pleasant view	16	15	13	26	13
Near public transportation	15	12	8	23	16

**Table 8.** In what street what kind of street like residents to live? Phuong Mai and Bach Mai Street group.

#### *Concluding remarks on assumption B*

Based on the resident preferences and the significant differences in education level it follows that socio-demographic characteristics of residents change when traffic volume is altered. However, further analyses showed that it is unlikely that socio-demographic variables have an interfering impact on livability in this experiment. Education level only influences the livability indicator privacy and home territory, whereas the differences in preferences across street types are minor.

#### **Assumption C: Residential self-selection remains constant when traffic volume is altered**

Residents that care more than average about the nuisances of heavy traffic might go and live more often on light traffic streets and will be overrepresented in the sample there. Assumption C will be tested with two relatively simple analyses.

#### *Preference for a low traffic volume neighbourhood*

Assuming that high traffic safety, low air pollution and a quiet street are reasons to live in a low traffic volume neighbourhood, it seems that differences in attitudes to live in a low traffic volume neighbourhood across street types are small. In the survey 41 of the 180 respondents rather lived on a quiet street than close to their job, while finding it also extremely important to be safe from traffic and have minimal air pollution. Half of these respondents lived on a heavy traffic street. Hence, residents with these characteristics do not live more often in low traffic volume neighbourhoods. Weaknesses of this analyses include that only some attitudes have been measured, the attitude of the respondent

might be influenced by the current traffic volume on their street, and may differ in the present day from those leading to the prior choice of the built environment.

#### *Relatively long length of residence*

Second, as the personal motorised traffic growth has been high across Hanoi in recent years and as residents live averagely 18 years in a street most of them moved to their street before the traffic became heavy. In-depth interviews confirm that traffic volume was far less in Phuong Mai and Bach Mai before. The high length of residence lowers the impact of self-selection, as the heavy traffic volume was significantly less when residents moved to their street.

#### *Concluding remarks on assumption C*

Given the averagely high length of residence of respondents and the small differences in attitudes towards the importance to live at low traffic neighbourhoods at different street types, the effects of residential self-selection are likely to be limited. Moreover, if households self-select into areas that have little traffic, it seems self-evident that traffic volume matters. Otherwise, people who prefer to live in a low traffic volume neighbourhood might as well settle into areas that have heavy traffic. If residential self-selection exists, it might weaken the experiment by over representing residents that prefer little traffic areas in light traffic streets, but it is also an argument that low traffic volumes are important to residents. In conclusion, it is unlikely that residential self-selection interferes with the measured relation between traffic volume and livability in this experiment.

#### **Concluding remarks for environmental variables other than traffic volume**

Environmental variables other than traffic volume change when traffic volume is altered. However, it is unlikely that these variables significantly influence the relation between livability and traffic volume in this experiment. The highest risks poses the street environment as it changes somewhat when traffic volume is altered and implications of these changes on livability are sometimes unclear.

### **4.3 Traffic hazard**

The construct “traffic hazard” considers the danger of traffic, for instance by not following traffic regulations or excessive speeds. According to the survey results did residents on light traffic streets experience a significantly lower traffic hazard ( $M = .362, SE = .012$ ), compared to those on heavy traffic streets ( $M = .5094, SE = .012$ ),  $t(172) = -8.59, p < .01$ , it represents a large-size effect,  $r = .55$ . On average, residents along heavy traffic streets experienced significantly higher amount, higher speed and higher danger of traffic than those along light traffic streets. In addition, the feeling of safety, the presence of aggressive drivers and the quality of walking conditions were perceived significantly worse at heavy traffic streets.

Figure 10 shows the seven questions considering traffic hazard. Remarkable is that respondents of heavy traffic streets are quite neutral considering the danger of traffic and the feeling of safety at their street, apparently these are not a significant problem for most respondents. However, when asked whether the street is a good street for children to grow up, respondents become more critical. Of the respondents on light traffic streets 6% value their street as not very good for children to grow up, compared to 35% at heavy traffic streets. Children are mostly not allowed to play outdoors along heavy traffic streets. Children living alongside light traffic streets can play outside more often, but parents state that they are afraid that something might happen to them.

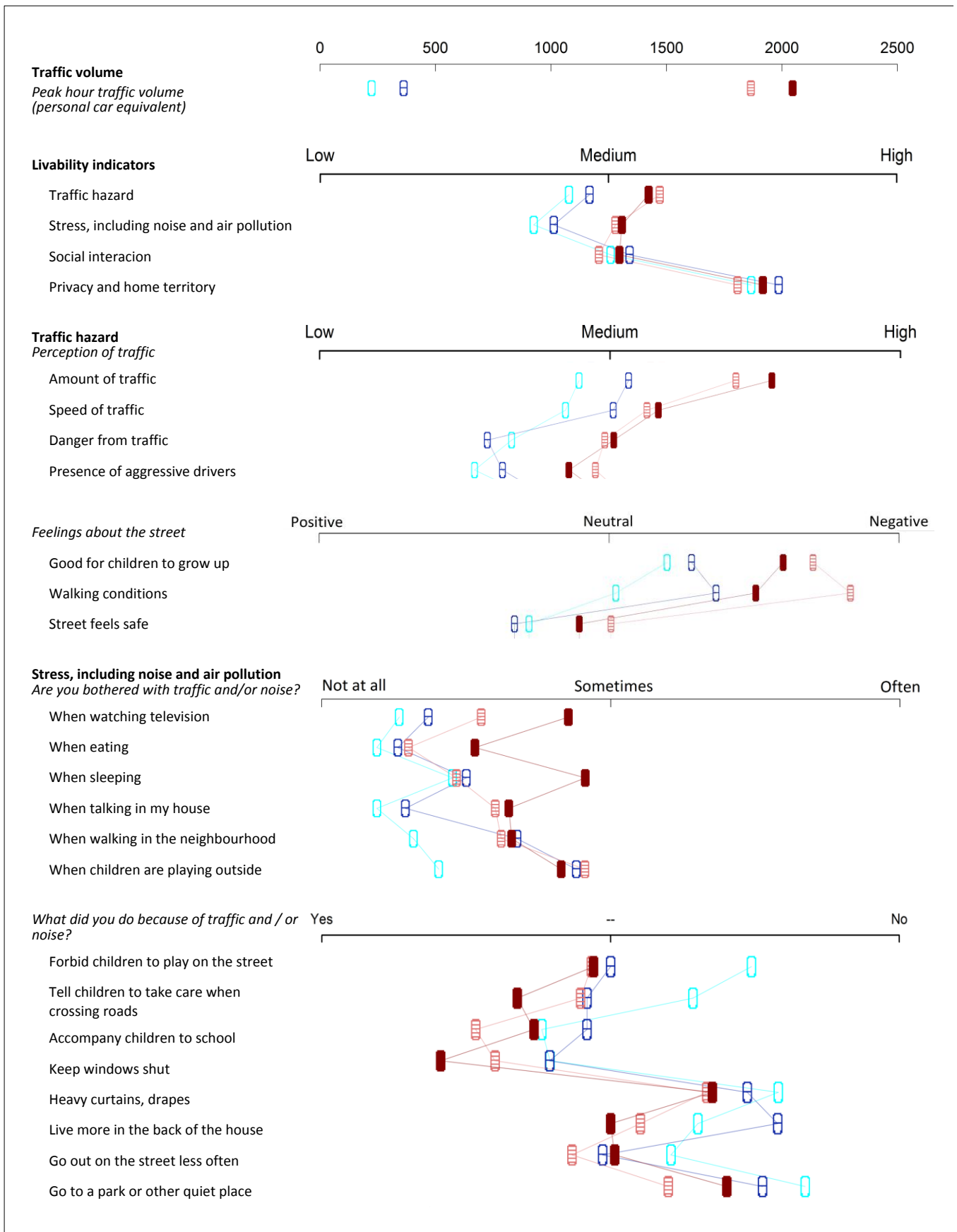
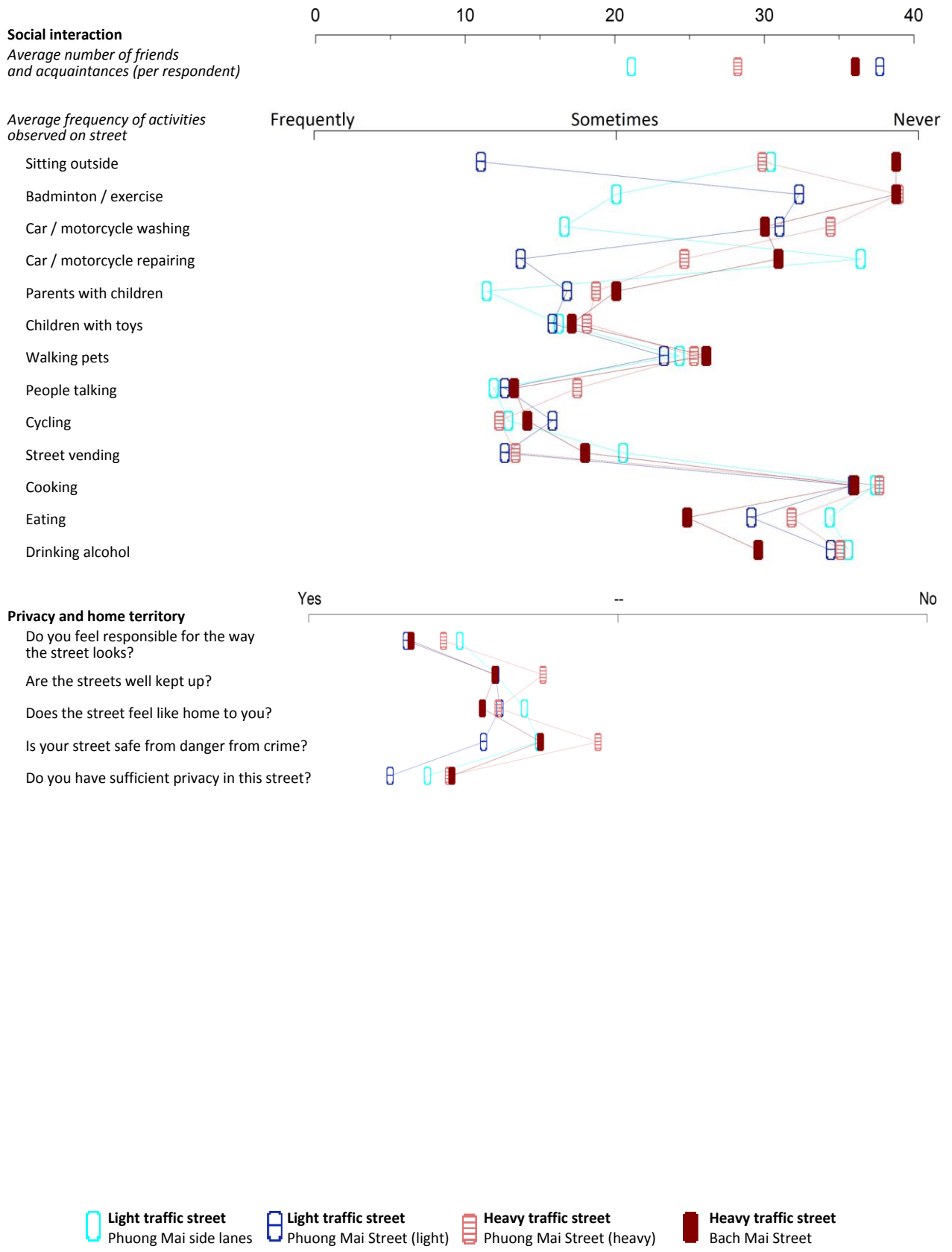


Figure 10. Summary of residents' responses to survey questions categorised per livability indicator. Phuong Mai and Bach Mai street group.





### **Walking conditions**

Especially the walking conditions are valued poorly at the heavy section of Phuong Mai Street, which has many shops and a few hospitals but the width of the footpath is just one meter at each side with many obstructions. The light traffic streets also have a similar sidewalk, but according to one of the interviewees this is not a problem as they can safely walk on the street. Interviewees of heavy traffic streets commented that the pedestrian path was often not available, "that means the pedestrian pavement is occupied and pedestrians have to walk on the street". A roadway is not meant for walking, and even crossing the street are problematic for some, "(Traffic) prevents me from crossing over and going to the big market. I will be able to buy a lot more things if I can go to the other side of the street" or "Well, it is rather difficult to walk on this street. Only in the morning you can walk without any vehicles", while at a light traffic street a resident uttered the following, "Quiet, good environment. That's life".

### **Concluding remarks on traffic hazard**

According to the traffic hazard survey questions the following hypothesis is confirmed:

*A low traffic volume reduces the perception of traffic hazard of residents in Hanoi.*

All seven questions considering traffic hazard show a significantly lower perception of traffic hazard at light traffic streets compared to heavy traffic streets. It is remarkable that the safety of the street is marked as neutral on heavy traffic streets, whereas these are valued unfit for walking and raising children. On light traffic streets the average score of activities as raising children and walking are also perceived between unfit and neutral.

## **4.4 Stress, including noise and air pollution**

Noise, fumes, trash and vibrations may be stressful for people, both in the street and at home. According to the survey results did residents along light traffic streets experience significantly lower stress, also considering noise and air pollution ( $M = .291, SE = .018$ ), compared to those along heavy traffic streets ( $M = .445, SE = .019$ ),  $t(153) = -5.28, p < .01$ , it represents a medium-size effect,  $r = .41$ . The section discusses whether residents were bothered by traffic, and the perception of noise and air pollution. Lastly, elderly may be highly sensitive for stress as they are a more vulnerable group of traffic participants.

### **Bothered by traffic**

On average, residents were in between 'sometimes' and 'not at all' bothered by traffic when watching television, sleeping, eating, talking in house, walking in the neighbourhood and when children were playing outside. Residents along heavy traffic streets, however, were significantly more bothered with traffic on their street when watching television, sleeping, eating, and talking in house. There was no such relation for when walking in the neighbourhood and when children were playing outside. Remarkable is that the Phuong Mai Side lanes were the least bothered with traffic (see Figure 10).

### **Noise and air pollution**

On average, noise level was valued "about the same as most streets" on light traffic streets and "fairly noisy" in heavy traffic streets. While the perceived noise level of streets rises significantly with traffic volume, people were bothered by noise about the same amount for all four streets. One resident of a heavy traffic street said, "When I had lived here for several months, initially I could not stand noise. Gradually I felt this street is still better than others". Whereas at the light traffic street someone responded, "I really like having a quiet street. It's nice to come home from work. I'd rather choose a quiet place though it is far". However, most residents shut their windows and were also concerned about air quality.

### **Impact of traffic on elderly and children**

An example of how stress is caused by traffic follows from the result that elderly along heavy traffic streets admit they are afraid of the traffic. In the survey participated 62 residents of 60 years and older. Of them, 40% of the residents living on heavy traffic streets said they were sometimes, quite often or very often afraid to go out on the street, compared to 22% on light traffic streets. One of the interviewees described the traffic as “very stressful at rush hour”. The traffic hazard section already showed how children were less able to play outside at heavy traffic streets, parents are afraid to let children play on the street. Vulnerable groups as children and elderly seem quite affected by heavy traffic.

### **Concluding remarks on stress, including noise and air pollution**

According to these results, the following hypothesis is confirmed:

*A low traffic volume reduces the perception of stress of residents in Hanoi.*

The street with the lowest traffic volume perceived the street the most comfortable at most questions. Noteworthy is that elderly and children are more than averagely affected by the adverse effects of heavy traffic.

## **4.5 Social interaction**

The construct “social interaction” considers the number of friends people possess on the street and the friendliness of the street. According to the survey results did residents along light traffic streets not experience a significantly higher level of social interaction ( $M = .44, SE = .016$ ), than those along heavy traffic volume streets ( $M = .43, SE = .014$ ),  $t(134) = .768, p > .05$ . Activities that happen on the street and friendship patterns mainly determine social interaction. Friendship patterns follow from indicating friends on a street map and asking the number of friends and/or acquaintances people possess. The section also describes some other variables that may influence friendship patterns.

### **Activities that happen in the street**

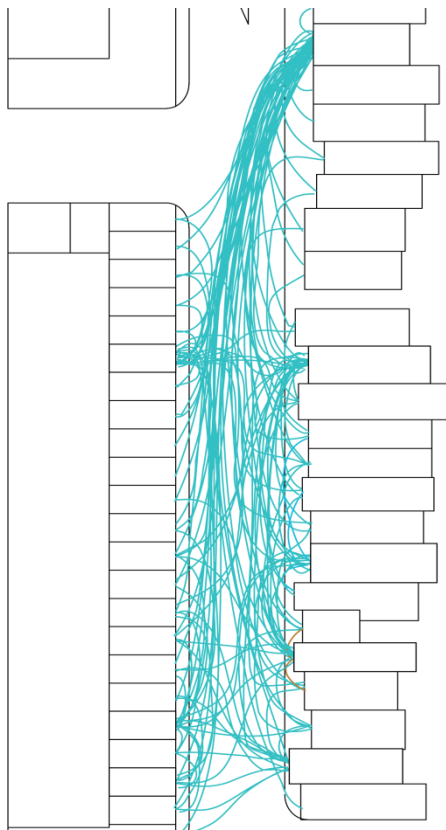
People along all streets participated and agreed with street activities (see Figure 10). Significant differences across street types do exist for some activities that happen on the street: drinking alcohol, sitting outside, car/motorcycle washing, and parents supervising children. People on light traffic streets participate a little more in activities than those on heavy traffic streets. Land use diversity is higher at heavy than light traffic streets. This may keep the number of activities high at both street types, while the sort of activities differ. Drinking alcohol is more popular at heavy traffic streets, whereas sitting outside, car/motorcycle washing and parents supervising children is more popular at light traffic streets.

### **Indicating friends on a street map**

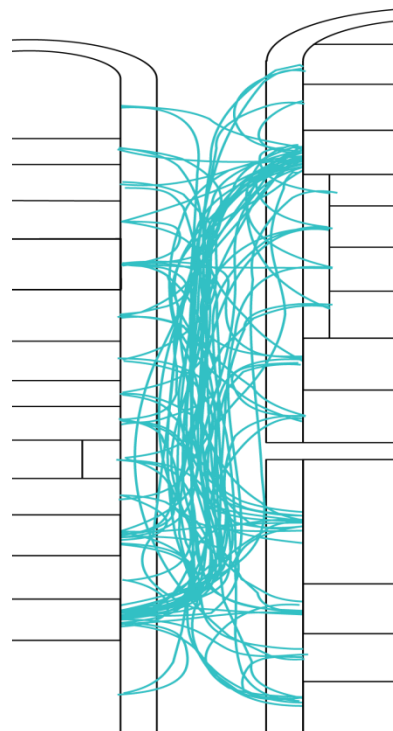
Residents were asked to indicate the homes of people that they knew by sight on a map of their street. Figure 11 shows eight randomly chosen responses per street compiled into composite maps. Residents of the four streets had a similar number of friends and acquaintances. The average number of friends and acquaintances per respondent varies from 22 till 35 households, a high number at every street. One responded expressed this by saying that “people have good relations with others”. The Phuong Mai side lanes has a lower number of friends and acquaintances, contains fewer houses and is smaller in width than the other streets. Given the low number of households, the potential number of friends and acquaintances is also lower there.

### **Does traffic flow influence friendship patterns?**

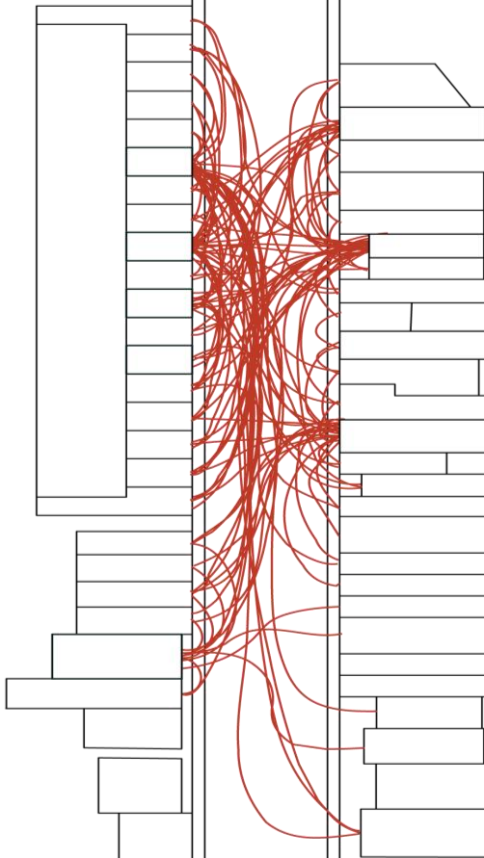
Most interviewees do not think that the amount of traffic influences community engagement, the first interviewee captures the general thought of most interviewees, whereas the latter thinks differently. “Whether the area is busy or empty, the relationship won’t be affected. Because it is not the kind of



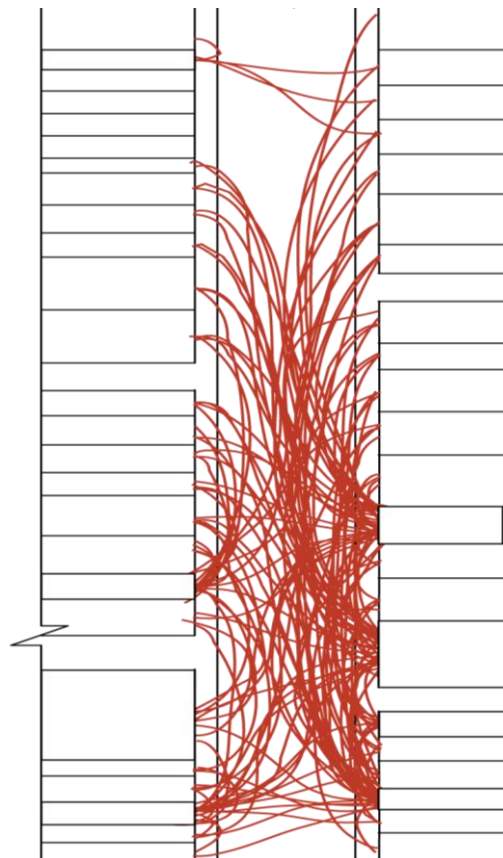
Light traffic Phuong Mai Street  
135 Friends or acquaintances  
Of which 83 at the same side of the street



Light traffic Phuong Mai side lanes  
86 Friends or acquaintances  
Of which 44 at the same side of the street



Heavy traffic Phuong Mai Street  
128 Friends and acquaintances  
Of which 77 at the same side of the street as the respondent



Heavy traffic Bach Mai Street  
140 Friends and acquaintances  
Of which 83 at the same side of the street as the respondent

**Figure 11.** Composite maps: lines show where people said they had friends or acquaintances. Phuong Mai and Bach Mai Street group.

living here that you stay for (only) one or two years. Like me, I have lived here for almost 20 years, whether the relationship is good or bad also (...) depends on ourselves”, but one person at a heavy traffic street though “Yes, friendlier. It is easier to visit other (residents). Now I feel hesitant to cross over. We communicate with each other less. I only go to meetings that are organized in the same block or in the same residential building in the evening (as where I live)”.

#### **Other variables influencing friendship patterns**

Bosselmann et al. (1999) argue that it is likely that friendship patterns are also influenced by other variables such as residential density, length of residence, presence or absence of children, common social concerns and issues affecting residents. Socio-economic status and the level of collectivism might also have some influence on friendship patterns. Hanoi has a residential density of 300 people/hectare (Schipper, 2008), the residential density is observed to be high across all four streets. The length of residence was found to be not significantly related to the social interaction indicator. On one light and one heavy traffic street residents lived there, respectively 23 and 24 years on average. On the other light and heavy traffic streets residents live significantly shorter, respectively 14 and 11 years. In Vietnam a house goes often from generation to generation within the family.

Furthermore, social concerns or issues strongly affecting residents outside the domain of transport and livability are not found in the study. The number of children below the age of ten is lower at heavy traffic streets, .64 child per household compared to .80 child per household. This seems logical, as light traffic streets are likely to be more suitable for raising children. This difference might follow from self-selection, as residents with young children choose not to live in heavy traffic streets. Self-selection and the influence of socio-economic status has been topic of discussion earlier in this chapter, see similarity of streets in section 3.2. Both are not likely to influence social interaction. The high level of social interaction in Hanoi may be a consequence of the high collectivism in Vietnam (Hofstede, 2001).

#### **Concluding remarks on social interaction**

According to these results the following hypothesis is rejected:

*A low traffic volume increases social interaction of residents in Hanoi.*

All kinds of activities take with different frequencies place across street types. The number of friends and acquaintances is high at each street. Probably because of a high land use diversity, high length of residence and high collectivism. The number of activities that take place at heavy traffic street is remarkable given the high traffic volume. Lastly, earlier in section 4.1 on data quality it followed that the validity of the construct social interaction is low but acceptable.

## **4.6 Privacy and home territory**

The construct “privacy and home territory” considers whether inhabitants feel they have sufficient privacy, and whether they have feelings of stewardship over their streets. According to the survey results did residents along light traffic streets not experience significantly higher privacy and home territory ( $M = .734$ ,  $SE = .015$ ), than along heavy traffic streets ( $M = .715$ ,  $SE = .015$ ),  $t(175) = 0.906$ ,  $p > .05$ . Upkeep of the houses is important at each street, and residents felt highly responsible for the way their street looked. A little more than half of the respondents at each street say that the street feels like home and respondents state that they have sufficient privacy. The level of danger from crime is the only question that differed significantly across street types; it is perceived significantly higher on heavy traffic streets (see Figure 10).

#### **Responsibility and privacy over the street**

The interviewees generally illustrate that privacy is not related to traffic volume. Two interviewees of a light and heavy traffic street commend respectively on the following question, “Do you think your

privacy is violated by the traffic?”, “No, I don’t” and “whether our privacy is ensured or not depends upon ourselves. People around here have their eyes on us, though they may not be our neighbours”. At heavy traffic streets privacy is sometimes disturbed by noise or passing strangers, but in general the interviews confirm that for privacy and home territory there are little differences across street types. At all streets residents feel highly responsible for how their street looks “I clean the sidewalk of the street outside my front door every morning. People do the same over there. In general, it is always clean outside every store”.

#### **Concluding remarks on privacy and home territory**

According to these results the following hypothesis is rejected:

*A low traffic volume increases the perception of privacy and home territory of residents in Hanoi.*

When discussing results per question, it follows that upkeep of the street, and responsibility over the street and privacy in the street are high at all four streets. Earlier in this chapter, section 4.1 on data quality, assessed that the survey measured poorly consistent responses for the construct privacy and home territory. There is a small change that outcomes of the construct differ when measured again at a similar survey population. Therefore, the individual questions are addressed above.

### **4.7 Research question 1.2 and 1.3**

The previous sections have described the results for the various livability indicators. The results will be employed in order to answer the following sub research questions:

#### *1.2 What is the livability of residents along streets with different traffic volumes?*

Figure 10 shows that that the perception traffic hazard and stress, including noise and air pollution, is between low and medium at both light traffic streets and about medium at both heavy traffic streets. Not at one street, respondents were often bothered with traffic when watching television, eating, sleeping or talking in the house. However, the amount of traffic and the walking conditions were valued negatively for the heavy traffic streets. At these streets residents frequently keep their windows shut and accompany children to school. Residents of the light traffic streets rated the amount of traffic and the walking conditions ‘medium’. Sometimes they also keep their windows shut or accompany children school.

The construct social interaction has a medium rating at each street. The number of friends and acquaintances is high and all kinds of activities take place at streets. However the rating is medium as some activities do not take place on most streets as sitting outside, exercising, cooking and drinking alcohol. When most activities did not frequently take place at a street, the construct does not reflect a high level of social interaction, which is quite substantial. Furthermore, when asked where most friends and family lived, it was mostly not on the street where they lived. This was also valued as negative for social interaction in the street. These are limitation of the aggregation method, which is primarily built to compare constructs across street types. On the basis of the individual questions results, the in-depth interviews and the question where people indicated friends on a street map, it is agreeable to value the livability indicator social interaction between medium and high. Furthermore, it is remarkable that the Phuong Mai side lanes forbid children to play on street less and tell them to take care when crossing streets less than all other streets. Privacy and home territory are valued high at each street. Upkeep of the houses is important at each street, and residents felt highly responsible for the way their street looked.

The livability at all streets is about average, whereas social interaction, privacy and home territory are rated as fairly positive. The heavy traffic streets show problems with traffic hazard and stress, including noise and air pollution. The Phuong Mai side lanes have the lowest traffic flow and have overall the best livability.

### *1.3 What can be learned from comparing livability of residents along streets with different traffic volumes in Hanoi?*

The comparison across street types follow from the hypotheses. According to the survey results did residents of both light traffic streets experience a significantly lower traffic hazard and stress, including noise and air pollution, compared to those at both heavy traffic volume streets. Social interaction and a feeling of privacy and home territory over the street of residents is fairly high at all survey streets in Hanoi. Heavy traffic streets especially affected vulnerable groups as elderly and children. Children were not able to play on these streets and elderly were afraid of traffic. The next section, conclusions, will explain what this comparison means and examine the objective.

## 5 Conclusions and recommendations

Since streets are places where children and elderly spend their lives, they are, outside the home, the most important part of our urban environment (D. Appleyard et al., 1981). The ideal street would be a safe sanctuary and community, where neighbours sit and talk easily, where children can play and learn about the world. Yet, today the streets in Hanoi are often polluted, noisy and dangerous. The objective of this study is therefore to assess the impact of traffic volume on livability of residents along residential streets in Hanoi. The main conclusions, recommendations, limitations and reflections follow below.

### 5.1 Conclusions

The streets of Hanoi are known for their chaotic and busy traffic. Residents on two light and two heavy traffic streets were asked what it is like to live there and how the traffic affects livability. The study led to the following results:

- *Result A: Overall, residents on light traffic streets experience significantly less traffic hazard and stress, including nuisance from noise and air pollution, than residents on heavy traffic streets in Hanoi.*

Result A is in line with the results of Appleyard (1981). The inverse correlation of high traffic volumes and poor livability did hold true for the perception of traffic hazard and stress on the four streets studied. This result is supported by how people valued traffic conditions and how they were bothered with traffic at each street. For instance, residents highly valued quality of walking conditions and the traffic safety at light traffic streets, whereas residents were bothered with traffic when eating, talking and sleeping at heavy traffic streets.

- *Result B: Social interaction and a feeling of privacy and home territory over the street of residents is fairly high along all four light and heavy traffic streets in Hanoi.*

Interestingly, result B is not in line with the results of Appleyard. The inverse correlation of high traffic volumes and poor livability did not hold true for social interaction, and privacy and home territory in Hanoi. The number of friends and acquaintances, the number of activities that take place and the feeling of responsibility over their street is high at all four streets.

### 5.2 Future research

For result B, an explanation for the contrasts between San Francisco and Hanoi might be related to contextual differences identified between the two cities. Compared to San Francisco forty years ago Hanoi has a very dense population in which the community relations are very strong and traffic consists of a high motorcycle share with a relatively low average speed. In addition, the survey found a high land use diversity and residents live a relatively long time in the same house. It seems that the Hanoi society reacts in a distinct way to heavy traffic. Possibly residents have sufficient reasons to still do the efforts to relate to each other despite the traffic volume. Some additional insights might follow from comparing Hanoi and San Francisco results into more depth.

To know better what actually happens in neighbourhoods when traffic volume changes in Hanoi, it could be interesting to look into the unused data collected for this research concerning environmental awareness. For environmental awareness, respondents were asked, among other things, to make a sketch of their street. Based on the level of detail of the sketch it could be assessed whether residents living along light traffic streets knew their street better than those living along heavy traffic streets. Due to time constraints this is not yet incorporated. Also a more extensive literature study and repeating a study that relates heavy traffic to residential quality of life in other cities might be beneficial for understanding how traffic volume has an impact on residents in South East Asian cities.



In addition, regression analysis, factor analysis and assessing livability by target groups might be beneficial to go a step beyond the gathered data. A factor analysis would be useful to validate the survey, while target groups could serve to determine differences in livability by age or wealth. For instance, the results suggest that vulnerable groups as children and elderly are stronger affected than others by heavy traffic in Hanoi. Furthermore, the collected data suggests that more wealthy families live less on heavy traffic streets in Hanoi, possibly to adverse negative impacts as traffic hazard and stress. If such urban contrast exists between light and heavy traffic streets, this may perhaps reveal a fraction of the inequality in Hanoi. Making this transparent could be important for reducing inequity there.

### 5.3 Recommendations

What could a street be like? Currently the balance between traffic and livability is tipped towards traffic in Hanoi. The level of accessibility is quite high owing to a high motorcycle share (JICA, 2007). However, the personal motorised vehicle traffic volume that is generated to reach this high accessibility is likely to be the cause of a perception of stress, inconvenience from air and noise pollution and traffic hazard at heavy traffic streets in Hanoi. The respondents valued living in a safe, secure, social, friendly, peaceful and clean air street as important (Table 8). What can be done? Melia (2011) proposes constraining personal motorised vehicles usage to prevent local deterioration. Possibly the level of accessibility can be maintained with encouraging mode shifts towards (electric) cycling and public transport. The compact city fabric and geographical location is quite suitable for cycling, which used to be popular back in 1995. Given the high density of Hanoi it seems also quite suitable for mass transit. However, the flexibility, speed and broadly comparable costs of motorcycles might undermine the development of public transport services. In Dutch cities there is a distinction between streets for residential purposes and streets for through traffic. Residential streets are part of protected neighbourhoods that have a street design that allows a high freedom for pedestrians, and sometimes limits access for other road users (CROW, 2004). Such a protected neighbourhood has many similarities with both surveyed light traffic streets in Hanoi and might be an alternative for the growing number of gated communities.

In sum, constraining personal motorised vehicle use and creating a distinction between through traffic and neighbourhood streets are both courses that most certainly are beneficial for livability of residents in Hanoi. However, apart from this technical approach Thomson (1983) and Gwilliam (2003) stress that perhaps it is more important to set up institutions with the political, financial and administrative capacity to plan urban transport and neighbourhood design. A solid institutional context can successfully address such courses.

### 5.4 Limitations

Some probable limitations considering resentment, adaption and representativeness may lessen the reach of the study. The study aimed to assess the relation between traffic flow and livability. First, the section reflects on whether environmental variables may interfere in the relation between livability and traffic volume. Then, it appraises resentment and adaption among other limitations.

#### **Environmental variables other than traffic volume influencing livability**

The research studies three environmental variables: street environment, socio-demographic characteristics and residential self-selection. The focus group expected especially little differences in populations and the street environment at the two compared street sections of Phuong Mai Street, as these sections are part of one and the same street. A careful selection of the study area aimed to constrain the effects of socio-economic characteristics and the street environment these on the experiment. The street environment changed somewhat when traffic volume was altered in the survey area. All but one changes can be quite well isolated, the share of office space is the most likely variable to interfere. In sum, it is unlikely that physical differences significantly interfere with the experiment.

Second, differences in socio-demographic characteristics between different streets might influence livability. Especially education level was higher at the light traffic streets. Further analyses showed that it is unlikely that socio-demographic variables like education influence livability in this experiment. Finally, residents that care more than average about the adverse effects of heavy traffic might go and live more frequently on light traffic streets and will be overrepresented in the sample there. In practise it is expected that the residents scarcely move for these reasons to light traffic volume streets. The attitudes towards living in an in low traffic volume neighbourhoods are quite similar across street types; it seems that residents of light traffic streets are not more prone to live on such an environment. In addition, on average residents moved 18 years ago to their house, when the personal motorised traffic volume was eightfold lower in Vietnam. Residential self-selection is unlikely to be an issue back then.

### **Adaption and resentment**

Residents can adapt to shortcomings and luxuries of their street environment in time, what might cause underestimation of these by the research instruments. The diversity of instruments, high sample size, and Appleyard's precautions in the design of his improved survey tool might alleviate these limitations. Appleyard introduced the survey as a neighbourhood improvement survey and asked after relative objective conditions as street activities. With these measures it is expected that the effect of adaption and resentment is muted.

### **Other limitations**

Applying Appleyard's western study in an Asian developing context might result in compatibility issues. A concept as livability could be differently perceived in Hanoi than San Francisco. The study therefore applies careful adjustment of the research instruments to the Hanoi context, involves many Vietnamese actors and considers the respondents' responses from in-depth interviews and the survey cautiously. Second, the weighting and selection of questions in the multi criteria analysis can influence results. A simple and transparent weighting and selection method is designed to limit this impact. The results of the majority of the individual questions, as well as the summaries of in-depth interviews in the study can endorse the constructs. A factor analyses would be beneficial for validating questions and matching them to a suitable construct. Furthermore, it is assumed that the four livability indicators are independent from each other. There is nothing undertaken to alleviate this apart from the question selection process. Lastly, formulating generalizations from the sample for the Hanoi population is explorative as the sampling only took place in just four streets and as the sample size of 180 is not representative for the Hanoi population.

## **5.5 Reflection**

With the three research instruments a lot of interesting data is gathered. I had no prior experience with questionnaires and some difficulty to analyse and report at the right level of detail. Going into too much detail would be time consuming, for instance by analysing and reporting all 122 questions of the survey, whereas a high level analyses might not reveal interesting information the data holds. In the design of the survey form it would have been beneficial to have less questions, more uniform questions and a solid data analyses plan next to the form. Currently the results section still could be expanded to discover more information from the resident responses.

While the data set is large, the share of literature is normal and therefore better controllable. I am very happy with the choice of applying the Appleyard methodology on the Hanoi case. Appleyard did his study rather thoroughly, which enabled me to stand on the shoulders of a giant. In addition, the theory is very interesting from both a scientific perspective given the contrasts in the Hanoi and San Francisco study results, and from a social perspective given the gathered empirical knowledge of the impact of traffic in their neighbourhood streets in Hanoi.

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## 7 Appendices

The appendices depict the development, methodologies and forms of the different research instruments. Appendix 7.1 contains the ‘Observations of the physical environment’ instrument, Appendix 7.2 the ‘In-depth interviews’ instrument and 7.3 the ‘Survey’ instrument.

### 7.1 Observations of the physical environment

This appendix contains the observation survey form used for the observations of the physical environment. The original form is developed by HealthBridge and adapted for the research.

#### Transport & livability observation survey form



Volunteer Name:  
Segment ID:

Date:  
Start Time

Section ID:  
End Time:

#### 0. Is road or water main construction underway?

Yes	No
<input type="checkbox"/> 1	<input type="checkbox"/> 2

If yes, skip all questions and begin next segment on a new sheet.

If no, continue to Question 1.

#### 1. Segment Type:

Low Volume Road	Medium Volume Road	High Volume Road	Path/No Road
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4

\*\* If no road, skip the “Safety” section

#### 2. Segment Intersections (check all that apply):

3 way intersection	4 way intersection	Other intersection
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
Segment ends but path continues	Segment ends	Segment has no intersections
<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6

#### Land Use Diversity

#### 3. Are residential and nonresidential land uses mixed in this segment?

None	Little mix	Some mix	A lot of mix
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4

#### 4. What uses do you see in this segment? (Check all)

Houses	Office	Public/ Government	Schools
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
Shops	Restaurant/ Cafe	Entertainment	Park/ Playground
<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7	<input type="checkbox"/> 8

#### Footpath Availability

#### 5. Presence of a footpath or walkway in segment?

None	Oneside	Both sides
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3

\*\* If no footpath or walkway skip to question 14

#### 6. Is the footpath/walkway complete in this segment?

Not complete	Complete oneside	Complete both sides
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3

#### Footpath Quality

#### 7. Is there a buffer between the road and path?

No buffer	Buffer less than 0.5m	Buffer 0.5m To 2m	Buffer is more than 2m
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4

#### 8. What materials are used for footpath/walkway? (Check all that apply)

Paving Brick	Concrete	Bitumen
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
Slab	Tiles	Dirt/Sand
<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
Other	<input type="checkbox"/> 7	
<input type="checkbox"/> 8		

#### 9. What is the width of the footpath/walkway?

Less than 0.5m	0.5m to 1m	1m to 2m	More than 2m
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4

#### 10. What is the condition of the footpath/walkway?

Poor (many heaves, broken sections)	Fair (some heaves, Broken sections)	Good (very few heaves, broken sections)
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3

#### 11. Are there obstructions blocking the footpath/ walkway? (Check all that apply)

Cars/ Motorbike	Trash cans	Construction rubbish	Car exit/ entry cuts
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
Shop goods	Pillars and cables	Trees	Vendors
<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7	<input type="checkbox"/> 8
Trucks	None	<input type="checkbox"/> 9	
<input type="checkbox"/> 9	<input type="checkbox"/> 10		

#### 12. What is the quantity of obstructions blocking the footpath/walkway?

None	A little	Some	A lot
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4

#### 13. Did you need to leave the footpath/walkway because of the obstructions?

Never	1-3 times	4+	Could not walk on path
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4

#### 14. Is there physical disorder visible in the segment (on footpath or road)? (Check all that apply)

Cans/bottles	Cigarette/bidi butts	Urine/Smell
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
Garbage	Broken glass	Graffiti
<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
None	<input type="checkbox"/> 7	
<input type="checkbox"/> 7		

<b>15. What is the overall cleanliness of the segment?</b>		
Poor (a lot of physical disorder)	Fair (some physical disorder)	Good (very few physical disorder)
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3

### Facilities for the Disabled

<b>16. Are there curvilinear or curb cuts on the footpath/walkways of this segment?</b>		
None	Some intersections	All intersections
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3

<b>17. Would a person in a wheelchair be able to travel along the footpath/walkway in this segment?</b>	
Yes	No
<input type="checkbox"/> 1	<input type="checkbox"/> 2

### Safety

**18. Are there barriers that make it difficult or prevent the pedestrian from crossing the street? Check all that apply)**

High medians	Barbed wire	Trees/plantings in medians
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
More than 2 lanes traffic	Mixed Traffic	None
<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6

**19. Are there crossing aids for pedestrians to cross the Street safely? (check all that apply)**

Zebra Crossing	Special Lights	Police Enforcement	Crossing Guard
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
Raised walkway	Signs	Underground/ Foot over bridge	Cars obey laws/ yield
<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7	<input type="checkbox"/> 8
None			
<input type="checkbox"/> 9			

**20. Are there traffic calming and controlling devices to reduce volume or speed? (check all that apply)**

Roundabout	Lane width restriction	Traffic signals
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
Speed humps	Signs other)	None
<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6

**21. What is the posted speed limit? if there is no posted limit, enter 999) \_\_\_\_\_**

**22. Do you see cars being driven in segment?**

Yes	No*
<input type="checkbox"/> 1	<input type="checkbox"/> 2

\*if no, skip to question 24

**23. Are there aggressive drivers (i.e. speeding, not giving pedestrians the right of way)?**

Yes	No
<input type="checkbox"/> 1	<input type="checkbox"/> 2

### Availability of Pedestrian Amenities

**24. What types of service amenities exist in the segment? (Check all that apply)**

Seating	Toilet	Trash bins
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
Vendors	Other	None
<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6

**25. Are there trees shading the walking area?**

None/very few	Some	Many/very dense
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3

**26. Are there lights? (Check all that apply)**

Road oriented lighting	Pedestrian scale lighting	Other lighting	No lighting
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4

### Other

**27. Are there vehicles parked on the road in this segment? (check all that apply)**

Yes – car/motorbike legal parking	Yes – cars/motorbike not legal	No cars/motorbike parked	N/A – no road
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
Yes – trucks Legal	Yes – trucks not legal	No trucks parked	
<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7	

**28. How much noise pollution is audible in this segment (e.g. traffic, construction, factories)?**

None	A little	Some	A lot
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4

**29. How many people do you see in this segment?**

None	1-6	7-14	15+
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4

**30. Are there children playing in this segment?**

Yes	No
<input type="checkbox"/> 1	<input type="checkbox"/> 2

**31. Are there people stopping to talk or greet one another?**

Yes	No
<input type="checkbox"/> 1	<input type="checkbox"/> 2

### Roadway quality

**32. What materials are used for the roadway? (check all that apply)**

Paving Brick	Concrete	Bitumen
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
Slab	Tiles	Dirt/sand
<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6
Other		
<input type="checkbox"/> 7		

33. What is the road width?

\_\_\_\_\_ meter

34. What is the condition of the roadway?

Poor (many heaves, broken sections)	Fair (some heaves, Broken sections)	Good (very few heaves, broken sections)
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3

35. Are there obstructions blocking the roadway?

(Check all that apply)

Cars/ Motorbike	Trash cans	Construction rubbish	Car exit/ entry cuts
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
Shop goods	Pillars and cables	Trees	Vendors
<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7	<input type="checkbox"/> 8
Trucks	None		
<input type="checkbox"/> 9	<input type="checkbox"/> 10		

36. What is the quantity of obstructions blocking the roadway?

None	A little	Some	A lot
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4

37. What kind of weather is it? (Check all that apply)

Clouded	Rain	Sun	Windy
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4

38. What is the temperature?

Normal	Warm	Hot	Very hot
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4

\*\*Note the end time

End

## 7.2 In-depth interviews

This appendix contains the guidelines and summaries of the in-depth interviews.

### 7.2.1 Guidelines in-depth interviews Hanoi

The following guidelines structured the interviews.

#### *Focus during the interview on four themes*

##### 1. *Social interaction*

Social interaction considers the friendliness of the street, the number of friends and acquaintances people possess, and the places where people meet.

##### 2. *Privacy and home territory*

Privacy and home territory considers whether inhabitants feel they have sufficient privacy, and whether they have feelings of stewardship over their streets.

##### 3. *Traffic hazard*

Traffic hazard considers the danger of traffic, for instance by not following traffic regulations or excessive speeds.

##### 4. *Stress, including noise and air pollution*

Noise, fumes, trash and vibrations may be stressful for people, both at the street and at home.

#### *Suggested questions to ask:*

### 1. Social interaction

- 1.1. Which activities happen on this street?
- 1.2. How friendly is your street?
- 1.3. Do you have a lot of family, friends and acquaintances here?
- 1.4. Do you think the community engagement is good on this street? Why?
- 1.5. Do you think you know so many people because there is little traffic here?

### 2. Privacy and home territory

- 2.1. Do you have feelings of responsibility over this street?
- 2.2. Does the street feel like home to you?
- 2.3. How far do you feel your home extends? Why?
- 2.4. Do you feel you have sufficient privacy on this street?
- 2.5. Do you feel home territory is low because of the traffic?
- 2.6. Do you feel privacy is low because of the traffic?

### 3. Traffic hazard

- 3.1. Do you feel it is a good street or children to grow up?
- 3.2. What do you think of traffic on your street?
- 3.3. Do you think the traffic is safe in your street? Why?
- 3.4. Do people follow traffic rules?
- 3.5. Can you give examples of both?
- 3.6. Have you or one of your household members been involved in any traffic accident?
- 3.7. How important is it to improve traffic condition on this street? Why?



## 4. Stress, including noise and air pollution

- 4.1. What do you think about noise on this street?
- 4.2. What do you think about the air quality on this street?
- 4.3. Are you disturbed by noise and/or air pollution in this street? How come?
- 4.4. What do you do to cope with the traffic?
- 4.5. Do you feel stressed sometimes? What is the cause for that?
- 4.6. How would you describe the walking conditions here?
- 4.7. Do you do things because of the traffic /noise? Like keeping windows shut, live more in the back of the house, or going out on the street less often?

## 5. General

- 5.1. If you had the choice of living on a busy street and getting to shopping, work and other places quickly or living on a secluded, quiet street and taking a long time to get where you 're going, which would you prefer? Why?
- 5.2. How was this street when the traffic was lower?
- 5.3. Main RQ: How does the traffic volume influence your residential life here?

## 6. End

- 6.1. Thank you for participating!
- 6.2. Recordings will be deleted in October
- 6.3. Anonymity
- 6.4. Give small amount (100) for interview, ask to sign

## 7. Interviewer focus

- 7.1. It is an neighbourhood improvement survey (at least in the beginning)
- 7.2. Try to ask approximately all questions at each street types, if it is an appropriate
- 7.3. When something possibly interesting comes up, you may focus on that, that is not possible in the questionnaire

### 7.2.2 Summaries and quotes of four interviews

Of our four streets, I analysed one interview per street below. After a summary of the interviews, quotes follow which are categorised by livability indicator (th, ss etc.) and traffic volume (l, h).

<i>Abbreviations</i>	
Th	Traffic hazard
Ss	Stress, including noise and air pollution
Nv	Social interaction
Pt	Privacy and home territory
l	Light traffic street
h	Heavy traffic street

### Summaries of four interviews

The Community is tight in all four streets, and there are community activities anywhere. Sometimes people feel watched too much in the high density city, but generally people feel they have enough privacy at home. In the light traffic streets children play a lot, noise is less and air quality is said to be better. This does not mean that parents feel it is very safe for children, as traffic is perceived dangerous in Hanoi. Traffic hazard and stress are clearly less in the light traffic streets, whereas the usage of the sidewalk is a problem for most interviews. Social interaction seems similar across street types, apart from the note that crossing the street is more difficult in heavy traffic streets. Home territory seems better understood in the in-depth interviews than for the questionnaires, specific descriptions of one's home territory seems more valuable than the multiple-choice answers, as there are different understandings over official boundaries of ownership and what residents socially perceive as 'home'. In contrast to the questionnaire, for the light traffic street the whole street feels like home for residents.

#### Interview 1: Bach Mai street (BM1, heavy)

The heavy traffic makes this woman not cross the street often and stay in the house more. Still, the community is very active and celebrates women's day and ceremonies. She feels responsible for her street and the street feels like home. However, the traffic density is very stressful at the rushhour, it is rather difficult to walk in the street, especially because the pedestrian pavement is occupied. It seems difficult to improve traffic conditions, she prefers the old days.

#### Interview 2: Phuong Mai Ngach 22 (PMS1, light)

The light traffic is nice as it results in some peace after busy working days at schools. Sometimes she walks from home but she usually does not use a sidewalk, she knows allays to avoid busy traffic. Being foreigner it seems that people are observing her and even following her sometimes. Most of her acquaintances are around the city or outside Vietnam, privacy is not a problem as she leaves Vietnam this year. Living on this street seems enjoyable, but the community might be very tight, maybe too tight. People follow traffic rules, children are playing till late night and the air quality is comparatively good.  
*US female 25 yr*

#### Interview 3: Phuong Mai (PML1, light)

He is living here for over 30 years and remembers the street as a small sand path. He is still working during weekdays and leaves the street at early morning and comes back late. When he arrives at the street he says he feels home and the community is tight.  
*Male 65 yr.*

#### Interview 4: Phuong Mai (PMH1, heavy)

She is both a resident and running a shop in the same street, which may colour her views. The high traffic volume may not be quiet, but is good for business. Social relations are also diplomatic and keeping up the street environment is important. She says she has adapted to busy traffic and that she is happy with all the facilities available in this area. After moving here she initially could not stand the noise, now she says she is more concerned about traffic jams at rush hours.  
*Female 45 yr.*

## Quotes

### 1. Th

#### a. L

- i. I really like having a quiet street. It's nice to come home from work. I'd rather choose a quiet place though it is far ... *PMS1*
- ii. Ne serious traffic accident *PML1*
- iii. Do people obey traffic rules on this street? You see. Obviously, people don't. How can it be good if motorbikes park on the street? *PML1*
- iv.

#### b. h

- i. At rush hour, it is very crowded. People come home from work. Traffic jams occur at the front of the school, or hospital. At that hour I just feel a little bit irritated. So I close the door all the time. That's why I feel quieter in here. *PMH1*
- ii. Do you think the traffic should be improved? If yes, how should it be improved? I am only thinking of traffic jams at certain hours. And the street should be flattened as the rough surface and potholes are very dangerous to drivers.
- iii. Regarding the traffic, do you think your privacy is affected by the traffic on this street? Yes. How is it affected? For example, it prevents me from crossing over and going to the big market. I will be able buy a lot more things if I can go to the other side. Otherwise I go to the small market in here to buy essential and trivial stuff. If I prepare for a party, I have to go to the big market. However, I rarely go there as now I choose to go to the supermarket. I only go there to buy some vegetables. *BM1*
- iv. That means the pavement is occupied and pedestrians have to walk on the street. *BM1*

### 2. Ss

#### a. L

- i. What about the air quality? Are you affected by the air quality? Yes, I am. How are you affected? It is difficult to say. Currently I don't yet know. What about your house? As you can see, I close door all the time. You close door to avoid noise or dust? To avoid dust most of the case. There is not much noise. Are you stressful when you are on this street? I feel happy if going out. *PML1*
- ii. You are not bothered by street noise, smoke or dust? I think the life here is much better than some other places. *PML1*
- iii. Are you afraid that your kids run and play on this street? Yes, certainly. The traffic in Vietnam is dangerous. As I said, they must be under my control. Is that right? Even when the street is empty. The emptier the street is, the more dangerous it is if children go out. *PML1*

#### b. h

- i. When I have lived here for several months, initially I could not stand noise. Gradually I felt this street is still better than others. *PMH1*
- ii. Only when people build a house around here, is it noisy.
- iii. What about vehicles? Don't they make noise? Yes. It is less noisy because my house has glass doors. I am still able to work inside. How do you assess the air quality? Very poor. Is it? Because it is contaminated. People from different regions have moved to live in this lane. They sell food, particularly, 'Bun vit' (duck noodle) is quite famous in Hanoi. They sell over there. Does the transport out there produce dust and noise? It is dusty at rush hour. Are you annoyed about dust and noise from the traffic? Very annoyed. There should be a cleaning truck to wet the street. Do they often wash the street? Rarely. *BM1*
- iv. Well, it is rather difficult to walk on this street. Only in the morning. You can walk without any vehicles. *BM1*

- v. How do you think about the traffic on this street? Traffic density? Yes. Very stressful. At the rush hour. *BM1*
3. Nv
- a. L
- i. There are always parents out with their kids. People playing badminton Women doing their exercises in the morning and in the evening. *PMS1*
- ii. There is always kids out playing. summer activities for children, music performance for women.*PMS1*
- iii. People have good relations with others.*PML1*
- iv. I must say community activities here are good.*PML1*
- b. h
- i. Less traffic? Yes. Would people spend more time talking with others? No, I don't think so. This area is used for trading. The shop owners rent houses to run their business; therefore they only care about their business. Of course they may greet when meeting others. But not quite close or friendly. They only talk in diplomatic way. You mean the traffic is not the main issue. It is not important. I think people living in the living quarter will probably have stronger attachment than those in trading area.*PMH1*
- ii. People who live on both sides of this street only know their house. Every cock crows on his own dunghill. *PMH1*
- iii. Many old men and women do exercises in early morning and late afternoon. *PMH1*
- iv. Do you have many acquaintances in this street? Quite many. Also many relatives. *BM1*
- v. Do you see the inhabitants meet or communicate with each other? They only meet at the meetings, residential unit meetings, Father Front's meetings, Red Cross's meetings, and donation. *BM1*
- vi. community activities? Women's Day, the 8th of March. They organize ceremonies *BM1*
- vii. If this street is less busy, do you think people will be more friendly and closer? Yes, friendlier. It is easier to visit other. Now I feel hesitate to cross over. We communicate with each other less. Only go to meetings that are organized in the same block or same residential unit in the evening. *BM1*
4. Pt
- a. L
- i. I don't litter at all. So I don't need to tidy up, because I'm renting so I don't feel ownership over this street. *PMS1*
- ii. Do you feel you have a sense of responsibility towards the clean-up and beauty of this area?
- iii. Your question is simple. I think, living in this cluster, anybody will voluntarily do such activities.*PML1*
- iv. It is true that when going home, I have the sense of my family life.*PML1*
- v. Going to neighbours who are very close to me is as comfortable as going home. As I told you before, people here have very good relations. As such, when returning to this street, I feel safe and comfortable.*PML1*
- vi. Reaching this street means you get home already.*PML1*
- vii. Do you think your privacy is violated by the traffic? No, I don't.*PML1*
- b. h
- i. Do you feel this street is your home? Yes. It is almost my home. *BM1*
- ii. Do you feel you are responsible for the street beauty? Yes. I support all requests for street beauty. *PMH1*
- iii. Do you find Phuong Mai Street friendly as your home? I don't know but I love this street, personally. Really? Why so? Though my house is small, it is convenient, near the market, school and hospital, near everything. *PMH1*

- iv. Where do you think your house should extend to? The house boundary? It is stated in the land use right certificate. *PMH1*
- v. Whether our privacy is ensured or not depends upon ourselves. Wherever we live, if we are not careful, it will be a matter. For houses at the front like ours, it is very sensitive. People around here have their eyes on us, though they may not be our neighbours. *PMH1*
- vi.

5. Other

a. L

- i. I think it's a fairly wealthy area *PMS1*
- ii. Quiet, good environment. That's life. *PML1*

b. H

- i. Do you think this street is good for children? I think it is good. How good is it? In what aspects? The living environment is not too complicated. I don't know. For example, I feel the security and living environment is ok. I mean there are not many social evils in this area. *PMH1*
- ii. This place is more convenient as everything is available. Dinh Cong is quieter, airy and open; good for relax. The street there is less busy. Here is convenient for my business. So I adapt myself to this area. So between such a quiet place as Dinh Cong and a busy place as here, which do you choose to live? I have to earn a living so I choose here. *PMH1*

## 7.3 Survey

This appendix contains the survey research method, form and question selection.

### 7.3.1 Survey research method

This research method stems originally from Appleyard (D. Appleyard et al., 1981) and is adjusted for this survey.

Below we describe the procedures followed in the survey conducted and funded by HealthBridge and the University of Twente Centre of Transport studies, and faculty of Geo-information Science and earth Observation. The fieldwork is conducted by Nguyễn Thi Hương and her team.

#### General approach

The overall objective of the survey is to determine the attitudes, opinions, and behaviour of a sample of adult residents in selected street sections in Hanoi. The data are gathered by in-home personal interviews conducted by trained survey research interviewers from Nguyễn Thi Hương.

#### Survey dates

The survey is conducted between 6 June and 20 June, 2012.

#### Interviewing hours

All interviewing are from 3:00 PM 9:00 PM on weekdays, and all day on the weekends from 9:00 AM to 9:00 PM. No interviewing is to be done at other hours, except if interviewers have call back appointments with respondents.

#### Sample size

A total of 4 x 72 quantitative interviews and 4 x 12 mappings will be completed.

#### Sample design

Interviewing is conducted at 4 sites throughout Hanoi. The areas to be surveyed within each site includes the residents of all the dwelling units on both sides of the street on a one, two, three block stretch of a given street. An exception is that only the residents of the dwellings that are facing the street are included in the survey.

Within each site our goal is to divide the total sample as evenly as possible between both sides of the street and between each one block segment of the particular site. To accomplish this we prepare lists of suitable houses and interviewers will be assigned quotas of completed interviews by segment using only households from the list. After listing and making an interview attempt at that first house, they continue along the street in a specified direction making first attempts on households listed. They then make second and third attempts (on different days at different times) to complete an interview at each of these households until the quota of interviews for that segment is completed. In buildings with two or more flats or apartments, interviews could be done at no more than one dwelling unit per floor and at no more than two dwelling units in the building. If the target sample size is not met, 2 interviews can be held at one household.

For each street section about 20 dwellings will be selected for the in-depth interviews and interviews including the mapping tool. The dwellings for the interviews with mapping and for the qualitative interviews will be randomly chosen from the number of dwellings facing the street.

#### Selection of respondents

Any adult 18 years of age or older is eligible for the interview. When more than one adult is at home when the interviewer called, the interviewer asked first to speak with the youngest male 18 or older who is at home. If no male is at home, then the oldest female 18 or older is interviewed. This method has been

demonstrated in the United States to produce an age-sex distribution that is reasonable close to the population parameters. For the interviews including the mapping tool an age stratification will be applied to have a from three equal age categories, the young (under 25), middle-aged (25-55), and the elderly (over 55).

#### Introductory Letter for the interviews

As soon as the interviewer introduced herself/himself at a household, she/he hands the person an introductory letter printed on HealthBridge letterhead explaining the sponsorship and purpose of the survey. Respondents are asked to read the letter before granting the interview and are encouraged to keep the letter after the interview is completed.

#### Questionnaire

The questionnaire content is the responsibility of the University of Twente and HealthBridge research team. Several preliminary forms of the questionnaire are pre-tested among a small number of respondents and revisions are made before the final form is printed in quantity for the survey. The interview, including the main questionnaire and a self-administered answer forms, will take about 15 to 20 minutes to conduct.

#### Interview supervision

Close controls are maintained throughout all stages of the interviewing effort which included the following:

1. **Personal Briefing of Interviewers:** The fieldwork coordinator and researcher together conducts a personal briefing for all interviewers who work on the project. The briefing session covers all aspects of respondent selection and questionnaire administration and includes a question and answer period to allow interviewers to clarify any problem areas.
2. **Written Instructions:** We also provide detailed written interviewer instructions to supplement the personal briefing. The instructions are used by interviewers as reference throughout the course of the field work.
3. **Review of First Work:** Interviewers are required to return their first two completed interviews to the project supervisors for personal inspection to be sure that the interviewer is correctly carrying out the assignment.
4. **Returning Interviews on a Periodic Basis:** To maintain close control over the quality of field work, each interviewer returns her/his completed interviews every other day. This allows supervising personnel to review each person's work carefully and to go over with them any additional instructions as needed.
5. **Review of Field Records and Contact Listing Sheets:** A further check on interviewer performance is a systematic review of their field records. Each interviewer is required to record all of the addresses at which she/he made an attempt to get an interview, and to describe the result of each attempt made (e.g. not-at-home, refusals, etc.). A review of these records provided an assessment of interviewer efficiency and the completeness of coverage which the survey attained.
6. **Extra attention for interviewer(s) carrying out interviews including the mapping tool:** The one or two interviewers that perform the interviews including the mapping tool will get some additional training and will be guided during their first two interviews by the fieldwork coordinator. Close contact with the fieldwork coordinator will stay during the interviewing period.

#### Data processing

As the interviewing is being done, the completed questionnaires are carefully reviewed for consistency and completeness by the researcher. Questionnaires are then serialized and at least 20% of the replies to each of the "open" questions are translated and systematically sampled by the researcher. Using the sample responses, tentative code categories are established to permit detailed coding and quantification of qualitative responses. The categories are reviewed before coding starts. The complete set of respondent data, along with all necessary supporting documents (e.g. column guides, code sheets, traffic counts, interviewing maps, etc.) are used for the final report. The first day of the data entry the researcher and fieldwork coordinator would like to visit to understand and approve the process.

### 7.3.2 Survey form

This survey form stems originally from Appleyard (D. Appleyard et al., 1981) and is adjusted for this survey.

Hello, I'm \_\_\_\_\_ with HealthBridge, a NGO defending public spaces in Hanoi. We are doing a survey on people's opinions of the places they live, what kinds of things make an area good to live in and what things create problems for people in a residential area. The survey findings will be used in planning improvements in residential areas of Hanoi.

FILL IN INFORMATION BELOW:

1. Set-back of the house/apartment  
(Distance from entrance from the street to resident part of the house)
  1. 0 meters
  2. More than 0 m

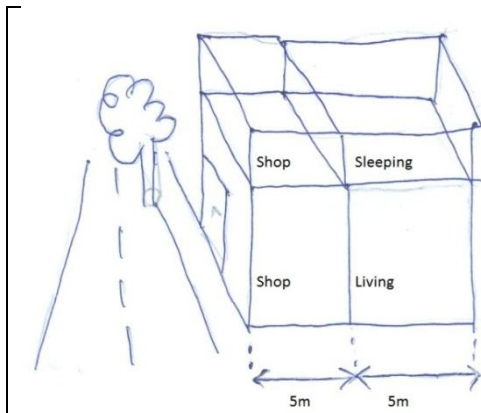


Figure 1: Set back = 5m

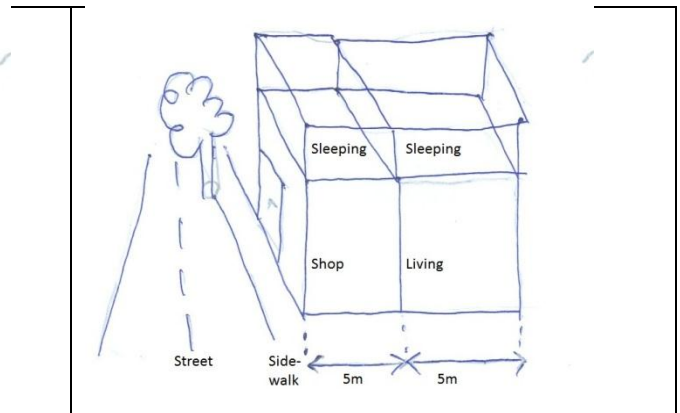


Figure 2: Set back = 0m

2. Did you enter the house/apartment via a door or entrance facing the street?
  1. Yes
  2. No

ONLY CONTINUES SURVEY WHEN ANSWERS FOR QUESTION 1 & 2 is (A).

Exception: If apartment is on the 1<sup>st</sup> floor of a communist building, still continue survey.

First, I'd like to talk generally about your neighbourhood and the street you live on...

1. Respondent's name \_\_\_\_\_
2. Street address \_\_\_\_\_



3. About how long have you lived here in this neighbourhood? (NOTE BELOW)
4. How long have you lived here in this house / apartment? (NOTE BELOW)

	Neighbourhood	House
Two years or less	1	1
3 – 6 years	2	2
7 – 14 years	3	3
15 – 29 years	4	4
30 years or more	5	5
Don't know	6	6

5. The next questions I'm going to ask you concerns the street you live on here. For the purpose of the questions, think of your street as.... (READ OUT LOUD AND MARK ONE OF THE OPTIONS BELOW)

1. Bach Mai street - from Dai Co Viet to section passing by Ngo Quynh
2. Phuong Mai street from after Gia Lieu hospital to Intersection with Luong Dinh Cua street
3. Phuong Mai street from Luong Dinh Cua street towards the end.
4. Phuong Mai street - ngach 4/14
5. Phuong Mai street - ngach 4/22
6. Phuong Mai street - ngach 4/26
7. Other

6. (SHOW CARD 1) Which of the statements on that card best describes your feelings all-in-all about living here on this street?
  1. I'm very happy here
  2. I'm fairly happy here
  3. I'm neither happy, nor unhappy here
  4. I'm fairly unhappy here
  5. I'm very unhappy here
  
7. In general, how good is this street for children to grow up on? Would you say it is... \*
  1. Excellent
  2. Very good
  3. Fairly good
  4. Not very good
  5. Very poor
  6. Don't know

Now, I'd like to talk about the appearance of the street...

8. (SHOW CARD 2) Which of the statements best describes how responsible you personally feel for the way the street looks and what happens on it (for example: keeping the street clean, safe, well maintained)? \*
1. Extremely responsible
  2. Quite responsible
  3. Somewhat responsible
  4. Only slightly responsible
  5. Not at all responsible
  6. Don't know, can't say
9. (SHOW CARD 3) Which statement best describes the way the buildings and sidewalks are kept up by the people who live on the street?
1. Very well kept up
  2. Fairly well kept up
  3. Satisfactory
  4. Not very well kept up
  5. Not at all kept up

Now, let's talk about how you regard this street as a place to live...

10. (SHOW CARD 4) Which statement best describes how much this street feels like home to you? \*
1. I most definitely think of this street as home
  2. I think of this street as home
  3. Suppose I might consider this street as home
  4. I don't think of this street as home
  5. I would never think of this street as home
  6. Don't know, can't say
11. (SHOW CARD 5) Some people feel that also the sidewalk or the street feels as part of their home. Which statement on this card best describes where you feel your home extends? (ALTERNATIVELY PHRASED: DO YOU FEEL AT HOME IN THE FOLLOWING AREAS?) \*
1. The whole block or more feels like home
  2. This building and out into the street
  3. Building and out into the sidewalk
  4. Just the building
  5. Just my own apartment/house
  6. Other, (specify)
- 
7. Don't know, can't say

12. (SHOW CARD 6) Please tell me how often, if at all, these activities go on here on your street, that is, in the street itself, the sidewalks and porch?

	Frequently	occasionally	don't
1. Walking pets	1	2	3
2. People talking	1	2	3
3. Drinking alcohol	1	2	3
4. Cycling	1	2	3
5. Sitting outside	1	2	3
6. Car/motorcycle washing	1	2	3
7. Playing with toys	1	2	3
8. Car/motorcycle repairing	1	2	3
9. Street vending	1	2	3
10. Parents supervising children	1	2	3
11. Eating	1	2	3
12. Badminton (exercise)	1	2	3
13. Cooking	1	2	3

13. Do you think your street is suitable for doing the activities listed in the previous question?
1. Yes
  2. No
  3. Don't know, depends

Now, let's talk about where your friends and relatives live...

14. Where do most of your friends live? Would you say they live... (READ ANSWER CATEGORIES)
1. On this street
  2. In this ward of Hanoi, but not this street
  3. Elsewhere in Hanoi
  4. Outside Hanoi

15. Where do most of your family live? Would you say they live... (READ ANSWER CATEGORIES)
1. On this street
  2. In this ward of Hanoi, but not this street
  3. Elsewhere in Hanoi
  4. Outside Hanoi

16. About how many friends and relatives do you see regularly who live on this street? Count each household as one set of friends or relatives. \*

\_\_\_\_\_

(Write in numbers)

17. In about how many households on this side of the street do you know people by sight? Count each household as one set of friends or relatives. (For example, acquaintances, friends, family) \*

\_\_\_\_\_

(Write in numbers)

18. In about how many households on the other side of the street do you know people by sight? Count each household as one set of friends or relatives. (For example, acquaintances, friends, family) \*

\_\_\_\_\_ (Write in numbers)

Now, let's talk about some things on this street and in your neighbourhood which may sometimes bother you.

19. What, if anything, bothers you the most about living on this street? (DO NOT READ THE ANSWER CATEGORIES, NOTE TWO ANSWERS) \*

1. Little greenery
2. Busy traffic
3. Dirty street
4. Too crowded
5. Little privacy (neighbours notice everything)
6. Parking
7. Other

(specify)

20. (SHOW CARD 7) Noises bother some people more than others. Which statement best describes how much noise usually bothers you?

1. I'm very easily bothered by noise
2. I'm fairly easily bothered by noise
3. I'm as easily bothered by noise as everyone else
4. I'm fairly little bothered by noise
5. I'm very little bothered by noise
6. Don't know

21. How noisy would you say your street is? (READ ANSWER CATEGORIES)

1. Very noisy
2. Fairly noisy
3. About the same as most streets
4. Not so noisy
5. Not noisy at all

22. How is the quality of the air on this street? (READ ANSWER CATEGORIES)

1. Very good
2. Fairly good
3. Reasonable
4. Fairly poor
5. Very poor
6. Don't know, can't say

23. (SHOW CARD 8) Some people in the city feel that their streets are dangerous from traffic, while other people think they are safe. Which statement on this card best describes the situation on this street and around your house with respect to danger from traffic? \*

1. Very safe
2. Quite safe
3. Neither safe, nor dangerous
4. Quite dangerous
5. Very dangerous
6. Don't know

24. (CARD 8) Still looking at that card, which statement best describes the situation on this street and around your house with respect to danger from crime? (For example, stealing, gangs, aggressive vendors)
1. Very safe
  2. Quite safe
  3. Neither safe, nor dangerous
  4. Quite dangerous
  5. Very dangerous
  6. Don't know
25. (SHOW CARD 9) Which statement best describes how often your privacy is disturbed by things that happen on this street (For example, traffic, crime, business)? \*
1. Very often
  2. Quite often
  3. Sometimes
  4. Hardly ever
  5. Never
  6. Don't know, can't say

Now, let's talk about the motorcycle, car and truck traffic on this street ...

26. (CARD 9) Are you afraid to go into the traffic on this street?
1. Very often
  2. Quite often
  3. Sometimes
  4. Hardly ever
  5. Never
  6. Don't know, can't say
27. How would you rate the amount of traffic on this street for a residential street? (READ ANSWER CATEGORIES) \*
1. Very heavy
  2. Fairly heavy
  3. About average
  4. Fairly light
  5. Very light
28. Do you think that the overall speed of traffic on this street is... (READ ANSWER CATEGORIES) \*
1. Much too fast
  2. Somewhat too fast
  3. About right
  4. Somewhat too slow
  5. Much too slow
29. How is the quality of the walking conditions of this street?
1. Very good
  2. Fairly good
  3. Not very good
  4. Very poor
  5. Extremely bad
  6. Don't know

30. How often do drivers honk, speed up, and not give a pedestrian right of way on this street?
1. Very often
  2. Quite often
  3. Sometimes
  4. Hardly ever
  5. Never
  6. Don't know, can't say
31. If you had the choice of living on a busy street and getting to shopping, work and other places quickly or living on a secluded, quiet street and taking a long time to get where you 're going, which would you prefer? (READ ANSWER CATEGORIES) \*
1. Busy street
  2. Quiet street
  3. Makes no difference
  4. Not sure, depends
32. For each of the following items I read, please tell me if traffic on your street bothers you often, sometimes, or not at all. (for example: noise, smell, busy traffic)

	Bothers often	Bothers sometimes	Bothers not at all	Can't say
1. When watching television	1	2	3	4
2. When eating	1	2	3	4
3. When sleeping	1	2	3	4
4. When talking in my house	1	2	3	4
5. When walking in the neighbourhood	1	2	3	4
6. When children are playing outside	1	2	3	4

33. Which do you do because of traffic, and/or noise?

	Yes	No
1. Keep window shut	1	2
2. Heavy curtains, drapes	1	2
3. Forbid children to play on the street	1	2
4. Tell children to take care when crossing roads	1	2
5. Accompany children to school	1	2
6. Live more in back of house	1	2
7. Go out on the streets less often	1	2
8. Go to a park or other quiet place	1	2
9. Others _____	1	2
10. None of these	1	2

34. Have you, or one of your household members been involved in any traffic accidents last year?  
If yes, did the accident happen on this street?
1. No
  2. Yes, an accident on this street
  3. Yes, an accident but not on this street
  4. Yes, accidents both on this street and other streets
  5. Don't know, can't say

\_\_\_\_\_ (specify type of accident(s) by vehicles and whether anybody got hurt)

Now, some background questions so your answers can be classified with the answers of other people in the survey

35. Do you or other members of your household own a motorcycle, car, or truck?
1. Yes
  2. No
36. What is the main occupation of the chief wage earner of this household? (IF RETIRED: What was the chief occupation when he/she was working?)
1. Domestic helper
  2. Workman
  3. Retailer
  4. Office worker in private sector
  5. Government officer
  6. Businessman
  7. Freelancer
  8. Other \_\_\_\_\_
37. Including yourself, how many people are there in this household?  
\_\_\_\_\_ (Number)
38. May I ask your age, please? And, how many people are there in each age group in this household? (NOTE BELOW & CHECK IF CORRESPONDS WITH QUESTION 39)

	Respondent	Other household members
Under 10 years old	___	___
10 – 19 years	___	___
20 – 29 years	___	___
30 – 39 years	___	___
40 – 49 years	___	___
50 – 59 years	___	___
60 – 69 years	___	___
70 or older	___	___

39. About how much time do you spend on this street, counting both the time inside and outdoors? (READ ANSWER CATEGORIES)
- |                                   | All | most | about half | little | none |
|-----------------------------------|-----|------|------------|--------|------|
| 6. Weekday during the day         | 1   | 2    | 3          | 4      | 5    |
| 7. Weekday evening                | 1   | 2    | 3          | 4      | 5    |
| 8. Weekends (Saturday and Sunday) | 1   | 2    | 3          | 4      | 5    |

40. (SHOW CARD 10) Now, we don't care to know your exact income, but would you please look at this card and tell me into which of these groups your total family income falls (formal and informal)?
1. Under 5,000,000 VND
  2. 5,000,000 – 10,000,000 VND
  3. 10,000,000 – 20,000,000 VND
  4. 20,000,000 – 50,000,000 VND
  5. 50,000,000 or over
  6. Refused, don't know
41. Do you own or rent the house?
1. Own
  2. Rent
42. What is your marital status?
1. Married
  2. Single
  3. Divorced, separated
  4. Widowed
43. What was the highest grade that you completed in education?
1. No education
  2. Primary school
  3. Secondary school
  4. Secondary school
  5. College, business or technical school
  6. University
44. Would you like to add any further ideas, comments or suggestions regarding this interview?
- 

INTERVIEWER: GO OVER BOOKLET WITH RESPONDENT TO BE SURE HE/ SHE UNDERSTANDS HOW TO FILL IT OUT. WHEN FINISHED, LOOK IT OVER CAREFULLY TO BE SURE IT IS COMPLETE AND THEN ATTACH TO THE BACK OF THIS QUESTIONNAIRE.

Fill in information below:

---

45. Respondent's Gender
1. Male
  2. Female
46. Respondent's housing
1. Single family house, one story
  2. Single family house, multiple story
  3. Flat, apartment in 2 to 3 unit building
  4. Flat, apartment in 4 to 9 unit building
  5. Flat, apartment in 10 to 19 unit building
  6. Flat, apartment in building with 20 or more units
  7. Other

(specify)

---



47. Respondent's housing

1. Part of commercial building
2. Communist housing
3. Only residential building
4. Building has other function, specify \_\_\_\_\_

48. Floor on which interview took place

1. fStreet level
2. Above street level

49. Time and date of interview \_\_\_\_\_

50. Interviewer name \_\_\_\_\_

**Booklet**

51. We will show you a statement. Please rate the statement by checking a box between two opposite words as in the example.

- Please check a box at every line
- Never put more than one check-mark per line
- Work quickly

Example:    1    2    3    4    5  
 Unattractive                                           Attractive

Living on this street makes me feel...

		1	2	3	4	5	
A53x1	Unhappy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Happy
A53x2	Lonely	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Not lonely
A53x3	Ashamed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Proud
A53x4	Angry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Peaceful
A53x5	Discontented	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Contented
A53x6	Unsafe	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Safe
A53x7	Neglected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cared for

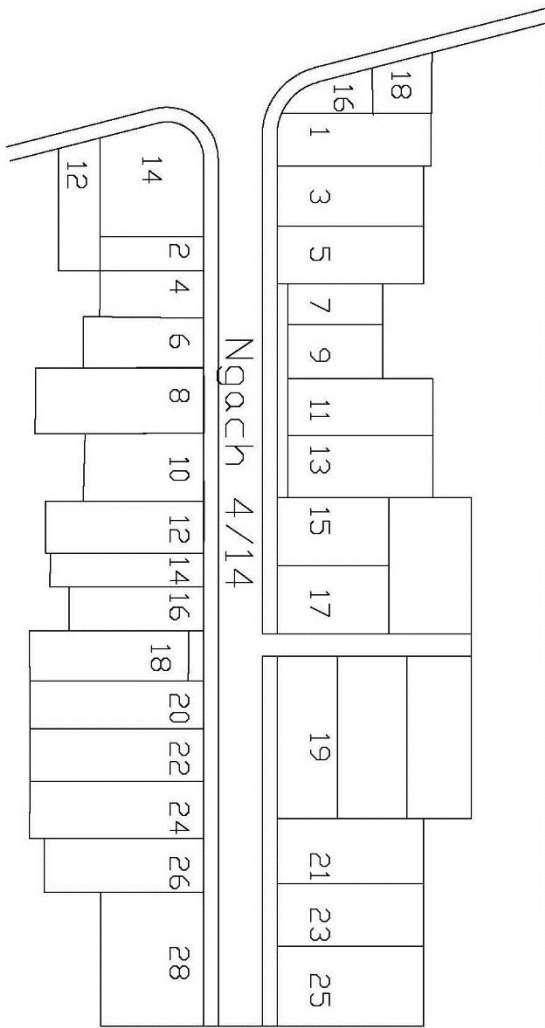
52. Below is a list of some things that are important to different people in deciding what street they want to live on in the city. For each one, please check how important or unimportant it is to you personally to have this.

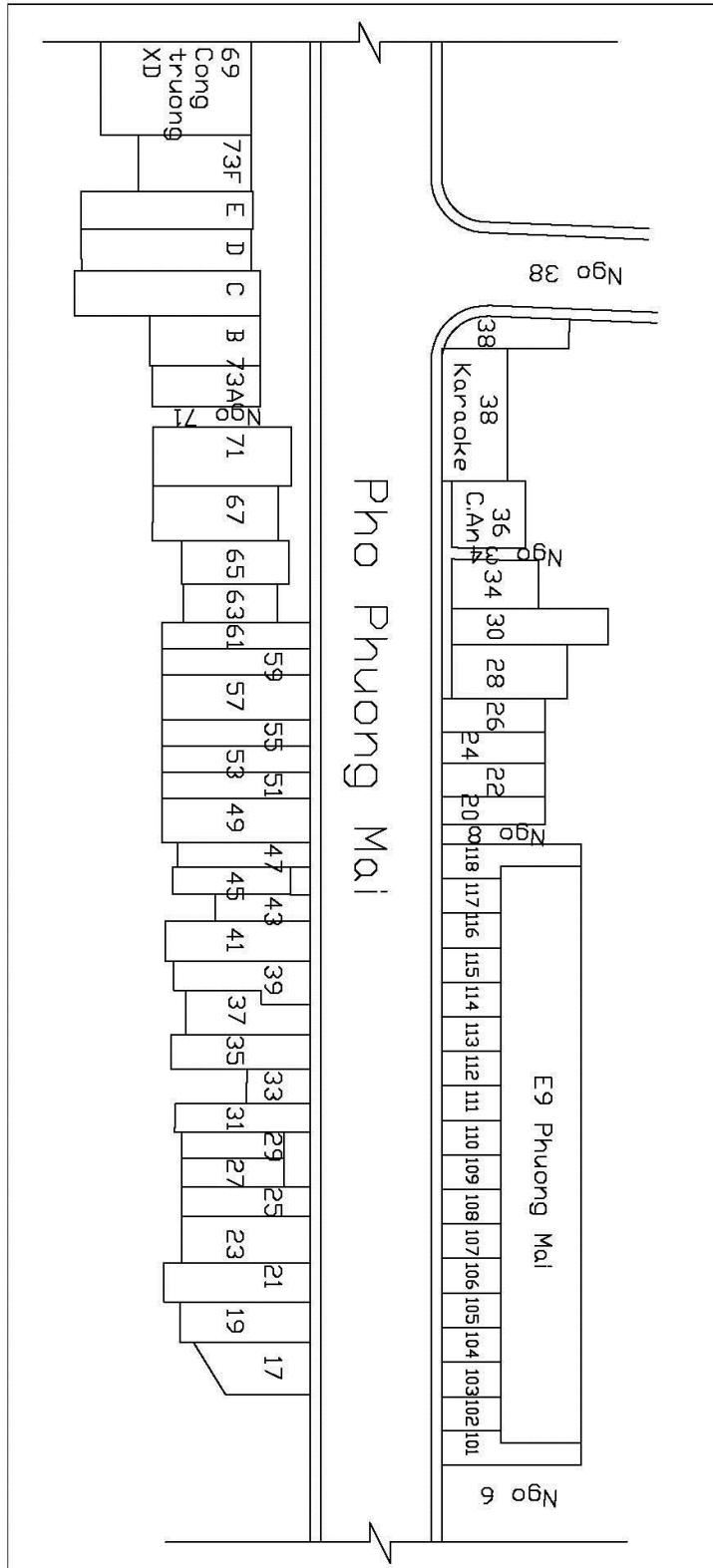
		Extremely important	Very important	Rather important	Not at all important
A54x1	Schools close to home	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x2	Convenient to downtown	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x3	Convenient to work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x4	Near public transportation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x5	Parks and recreational facilities nearby	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x6	Clean, uncluttered	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x7	Greenery: trees, grass and plantings along the street	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x8	Peaceful and quiet, not noisy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x9	Good walking conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x10	Privacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x11	Space for sport and leisure activities on pedestrian area i.e. badminton, chatting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x12	Sociable, friendly people	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x13	Good for children to play	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x14	Pleasant view	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x15	Prestige of area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x16	Safe and secure from crime	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x17	Safe and secure from traffic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x18	Cost of housing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A54x19	Minimal air pollution	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

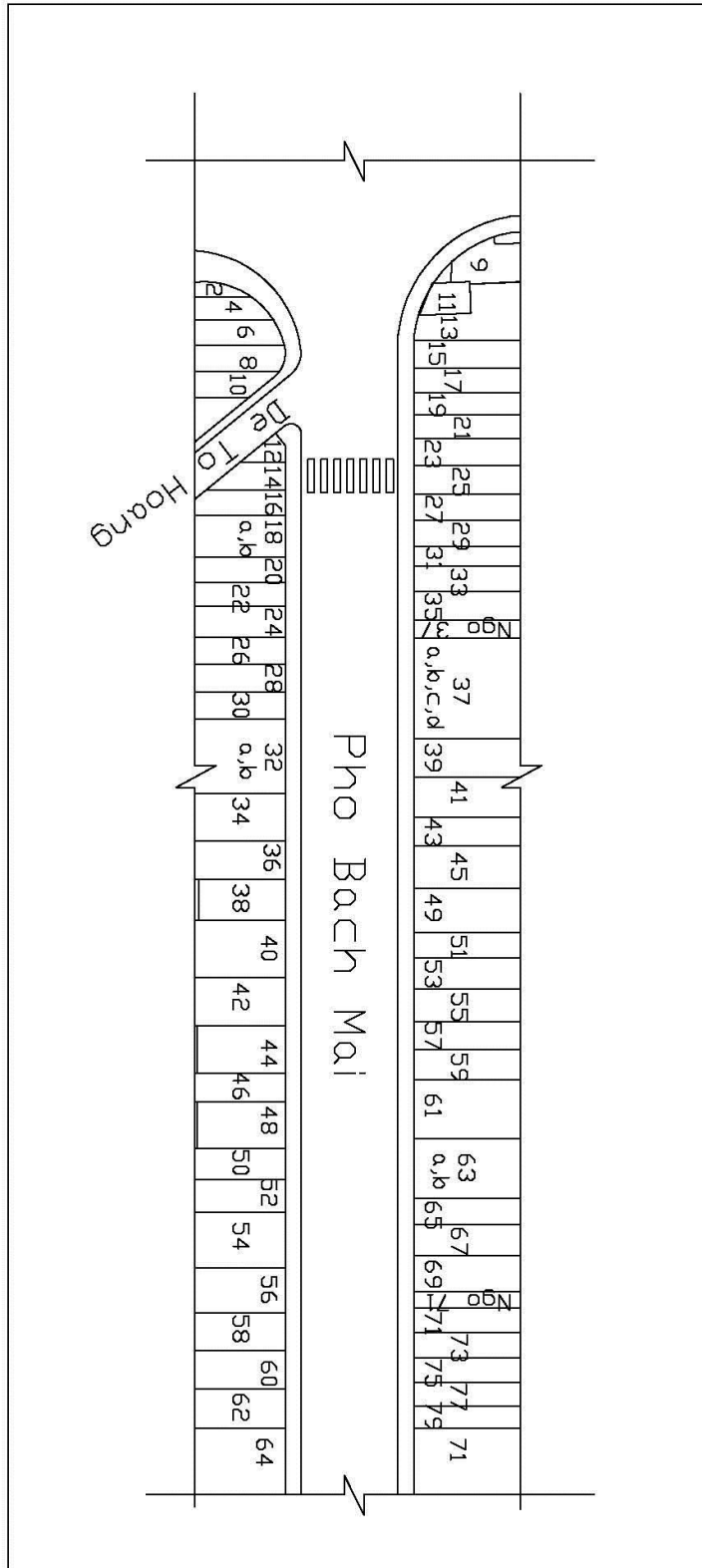
## Mapping research tool

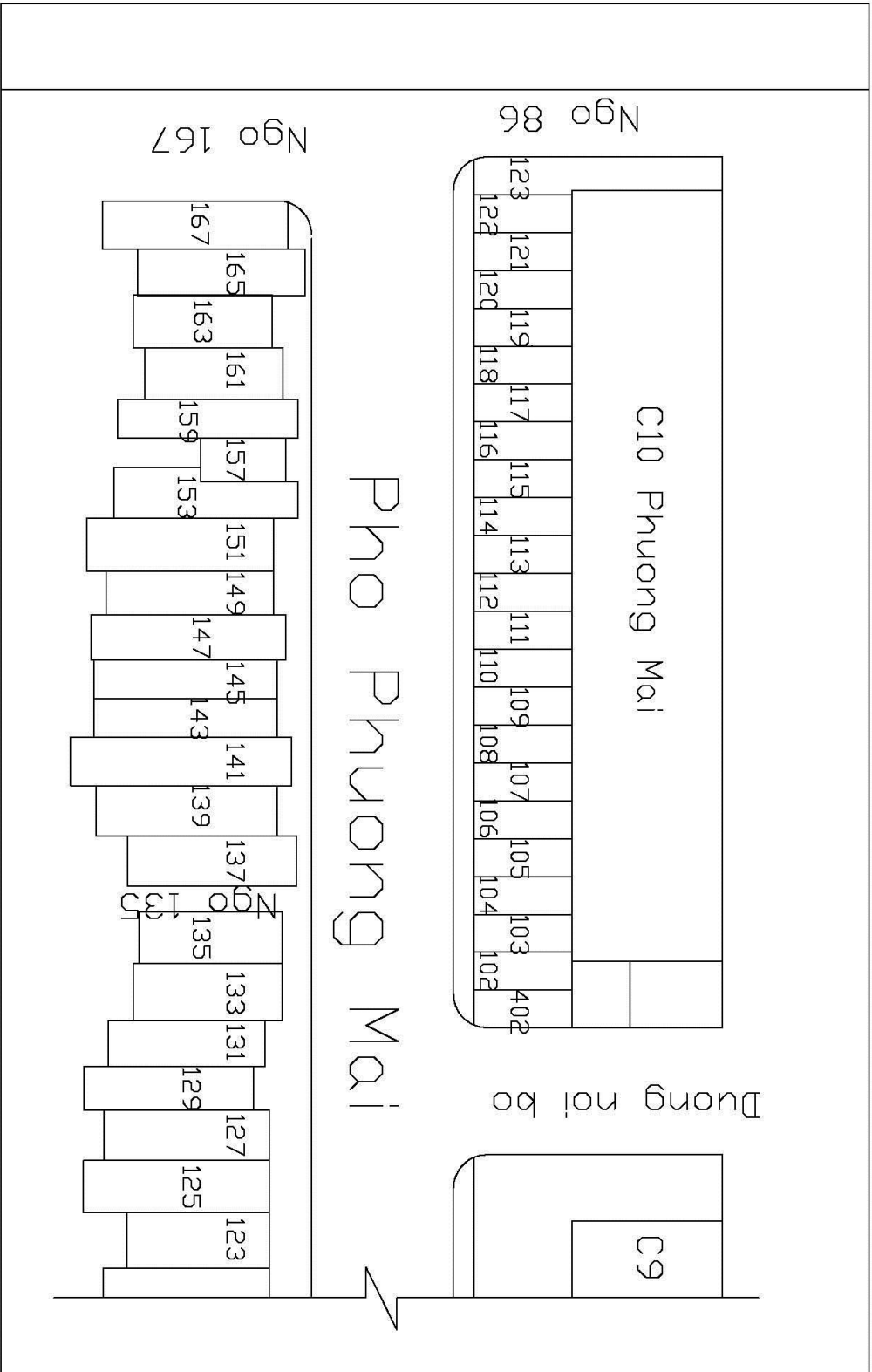
For the mapping research tool two questions will be asked.

53. Could you make a sketch, map or drawing from your street? (PROVIDE A PENCIL AND EMPTY SHEET)
  1. (DURING DRAWING: Are there some features or details you would like to add?) \*
  2. THE FOLLOWING PHRASES CAN BE USED TO COMFORT THE RESPONDENT
    1. Just draw any way you like
    2. You can sketch from above, or from the side
    3. It is not about whether you are a good artist or not, but it is an important question for the research
    4. There is no need to make a neatly sketch, a very rough sketch is perfect
    5. You may add names to indicate what parts of the sketch represent
  3. IF THE RESPONDENT IS NOT COMFORTABLE WITH DRAWING
    1. Could you otherwise describe the street?
    2. DURING DESCRIBING: Do you remember some additional features or details?
    3. WRITE DOWN ALL FEATURES & DETAILS DESCRIBED ON THE EMPTY SHEET  
FOR EXAMPLE: trees, balconies, wide sidewalk, vendors etc.
54. Please, show where any friends, relatives and acquaintances live on this map of the street?  
(SHOW MAP OF STREET BLOCK)\*











### 7.3.3 Survey question selection

#### Introduction

This appendix shows an overview of livability indicators and their corresponding questions, including the selection process of the questions. First, we list the livability indicators and variables proposed for the survey. Then, the question selection method and process preceding this list follows. The questions stem from Appleyard, Gerson and Lintell (1976; D. Appleyard et al., 1981), and some are newly created given the Hanoi context.

#### Questions selection method

Here is the categorization of livability indicators and questions discussed, and the selection method of questions. The first six question categories stem from Appleyard. The seventh considers mainly more general livability questions whereas the eighth category contain questions considering characteristics of streets and residents to be measured. The questions are listed in the following categories:

1. *Traffic hazard*
2. *Stress, including noise and air pollution*
3. *Social interaction*
4. *Privacy and home territory*
5. *Environmental awareness*
6. *Mobility, considering motorised vehicle use and ownership*
7. *Other question related to livability*
8. *Socio-demographic characteristics and preferences of residents*

Questions are selected on the following conditions:

1. *Practical*
2. *Objectivity*
3. *Explaining the livability indicator*
4. *Successful for Appleyard*
5. *Successful for Hanoi*

‘Practical’ indicates whether a question is easy to measure, to process and to analyse. The question should be understandable for interviewees. ‘Objectivity’ is important for obtaining unbiased results and the question should also successfully explain the corresponding livability indicator. This study aims to incorporate the most successful questions of the Appleyard study and considers whether the question will also be ‘successful for Hanoi’. The questions are expected to vary in value at the different streets there. If one of these conditions is expected to be rather high or low, it shall be mentioned in the remarks of the question. Below the symbolism for grading the conditions is added. Whether a question is incorporated in the survey and also in the multi criteria analysis is also showed in these tables.

#### Question selection legend:

+	Indicates positive score
0	Indicates neutral score
-	Indicates negative score
n/a	Stands for not applicable or not available
Y	Yes
N	No

Table 9 contains the survey question selection for traffic hazard.

Question	Practical	Objectivity	Explaining traffic hazard	Successful for Appleyard	Successful for Hanoi	Remarks	Question in survey	Question in MCA
<p>How would you rate the <u>amount of traffic</u> on this street for a residential street?</p> <p>6. Very heavy 7. Fairly heavy 8. About average 9. Fairly light 10. Very light 11.</p>	+	0	+	+	+	<p>The danger of traffic might follow from having heavy traffic volumes.</p> <p>As the amount of traffic in heavy traffic streets is high in Hanoi, it will be interesting to see whether residents perceive this traffic volume also as high.</p>	Y	Y
<p>Do you think that the overall <u>speed of traffic</u> on this street is...</p> <p>6. Much too fast 7. Somewhat too fast 8. About right 9. Somewhat too slow 10. Much too slow</p>	+	0	+	+	+	<p>Low speed traffic is not dangerous. Traffic speed is not that high in Hanoi, speed might keep the perception of traffic hazard low in Hanoi.</p>	Y	Y
<p>In general, how good is this street for children to grow up on? Would you say it is...</p> <p>7. Excellent 8. Very good 9. Fairly good 10. Not very good 11. Very poor 12. Don't know</p>	+	0	0	+	+	<p>If a street is good for children to grow up it will be safe. However, a street could also not be a good street for children to grow up cause of the pollution level, which has little to do with traffic hazard.</p> <p>Children are considered important in Vietnam according to Stephanie Geertman.</p>	Y	Y
<p>Please rate the statement by checking a box between two opposite words:</p> <p>Living on this street makes me feel...</p> <p>1 2 3 4 5</p> <p><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Safe</p> <p>Unsa e</p>	+	-	+	0	0	<p>Traffic hazard is partly about safety.</p>	Y	Y
<p>Some people in the city feel that their streets are dangerous from traffic, while other people think they are safe. Which statement on this card best describes the situation on this street and around your house with respect to <u>danger from traffic</u>?</p> <p>1. Very safe 2. Quite safe 3. Neither safe, nor dangerous 4. Quite dangerous 5. Very dangerous 6. Don't know</p>	+	0	+	+	+	<p>Danger is likely to be a severe problem in Hanoi.</p>	Y	Y
<p>How is the quality of the <u>walking conditions</u> of this street?</p> <p>1. Very good 2. Fairly good 3. Not very good 4. Very poor 5. Extremely bad</p>	+	0	0	n/a	+	<p>Good walking conditions can stimulate a clear separation from traffic on the street.</p>	Y	Y

Question	Practical	Objectivity	Explaining traffic hazard	Successful for Appleyard	Successful for Hanoi	Remarks	Question in survey	Question in MCA
6. Don't know								
How often do drivers honk, speed up, and not give a pedestrian right of way on this street? <ol style="list-style-type: none"> <li>1. Very often</li> <li>2. Quite often</li> <li>3. Sometimes</li> <li>4. Hardly ever</li> <li>5. Never</li> <li>6. Don't know, can't say</li> </ol>	+	0	+	n/a	+	Aggressive behaviour of drivers can add to traffic hazard.	y	y
Have you, or one of your household members been involved in any traffic accidents last year? If yes, did the accident happen on this street? <ol style="list-style-type: none"> <li>9. No</li> <li>10. Yes, an accident on this street</li> <li>11. Yes, an accident but not on this street</li> <li>12. Yes, accidents both on this street and other streets</li> <li>13. Don't know, can't say</li> </ol>	0	+	+	n/a	+	An accident is an objective measure of traffic hazard.	Y	N
Which statement describes traffic on this street as compared with other streets in this area of San Francisco? <ol style="list-style-type: none"> <li>1. This is the best street in this area</li> <li>2. This street is better than most streets in this area</li> <li>3. This street is comparable to other streets in this area</li> <li>4. This street is worse than most streets in this area</li> <li>5. This is the worst street in this area</li> </ol>	0	0	+	+	+	Comparing with other streets might be unpractical as respondents might prefer to know a specific street to compare with.	N	N
How long do you have to wait for traffic before crossing this street? <ol style="list-style-type: none"> <li>1. No wait at all; a few seconds</li> <li>2. About 1/2 a minute</li> <li>3. A minute or 2</li> <li>4. A few minutes or more</li> <li>5. Don't know, depends</li> </ol>	+	0	0	+	+	A long waiting time can be unpleasant for pedestrians.	N	N

**Table 9. Survey question selection for traffic hazard.**

Table 10 contains the survey question selection for stress, including noise and air pollution.

Question	Practical	Objectivity	Explaining stress, including noise and air pollution	Successful for Apleyard	Successful for Hanoi	Remarks	Question in survey	Question in MCA
Noises bother some people more than others. Which statement best describes how much noise usually bothers <u>you</u> ? <ol style="list-style-type: none"> <li>7. I'm very easily bothered by noise</li> <li>8. I'm fairly easily bothered by noise</li> <li>9. I'm as easily bothered by noise as everyone else</li> <li>10. I'm fairly little bothered by noise</li> <li>11. I'm very little bothered by noise</li> <li>12. Don't know</li> </ol>	+	0	+	0	0	This question may serve to diminish effects of self-selection, as it compares citizens with other citizens.	Y	Y
How noisy would you say your street is? <ol style="list-style-type: none"> <li>6. Very noisy</li> <li>7. Fairly noisy</li> <li>8. About the same as most streets</li> <li>9. Not so noisy</li> <li>10. Not noisy at all</li> </ol>	+	0	+	+	+	Here is asked after a relative objective condition.	Y	Y
For each of the following items I read, please tell me if traffic on your street bothers you often, sometimes, or not at all. (for example: noise, smell, busy traffic) <ol style="list-style-type: none"> <li>1. When watching television</li> <li>2. When eating</li> <li>3. When sleeping</li> <li>4. When talking in my house</li> <li>5. When walking in the neighbourhood</li> <li>6. When children are playing outside</li> </ol>	+	0	+	+	+	Here the severity of the bothering for different activities is questioned. Bothering might add to stress.	Y	Y
Which do you do because of traffic, and/or noise? Choose yes or no. <ol style="list-style-type: none"> <li>1. keep window shut</li> <li>2. Live more in back of house</li> <li>3. Forbid children to play on street</li> <li>4. Tell children not to cross certain streets</li> <li>5. Go out on the streets less often</li> <li>6. Add heavy curtains, drapes</li> <li>7. Accompany children to school</li> <li>8. Fenced or walled-in yard</li> <li>9. Planted trees or shrubs;</li> <li>10. Other</li> </ol>	0	0	0	+	+	Here it is asked after a relative objective condition. The question considering "Fenced or walled-in yard" is excluded as the number of yards is low in the selected streets.	Y	Y
What about traffic over the last few years? Has it improved or gotten worse, or has it stayed pretty much the same? <ol style="list-style-type: none"> <li>1. Improved a great deal</li> <li>2. Improved somewhat</li> <li>3. Stayed the same</li> <li>4. Gotten somewhat worse</li> <li>5. Gotten a great deal worse</li> <li>6. Don't know, didn't live here</li> </ol>	+	0	0	0	0	Not clearly related to stress but interesting for estimating self-selection.	N	N
Looking ahead five years from now, do you expect the traffic will improve, get worse, or stay pretty much the same? <ol style="list-style-type: none"> <li>1. Improve a great deal</li> </ol>	+	0	0	+	0	Not clearly related to stress.	N	N

Question	Practical	Objectivity	Explaining stress, including noise and air pollution	Successful for Apleyard	Successful for Hanoi	Remarks	Question in survey	Question in MCA
2. Improve somewhat 3. Stay the same 4. Get somewhat worse 5. Get a great deal worse 6. Don't know								
People sometimes mention that they feel afraid or worried about living on their street. Which best describes your feelings about this? 1. I've never felt afraid or worried because of my street and what happens on it 2. I've only felt afraid or worried on rare occasions 3. I sometimes feel afraid or worried 4. I often feel afraid or worried 5. I constantly feel afraid or worried 6. Don't know, can't say	+	0	+	+	+	When people are afraid of traffic this adds to their stress. But this question considers a similar aspects of stress as the next question.	N	N
Are you afraid to go into the traffic on this street? 1. Very often 2. Quite often 3. Sometimes 4. Hardly ever 5. Never 6. Don't know, can't say	+	0	+	+	+	This question is quite concise, making it quit practicable.	Y	Y
What, if anything, bothers you the most about living on this street? 1. Little greenery 2. Busy traffic 3. Dirty street 4. Too crowded 5. Little privacy (neighbours notice everything) 6. Parking 7. Other (specify) _____	0	0	+	n / a	+	This question may be difficult to analyse quantitatively.	Y	N
Do you, yourself have any problems shown on this card? 1. Allergies or sensitivities to things in the air 2. Chronic diseases other than allergies 3. Physical handicaps that make it hard to get around 4. Other (specify) _____	+	+	+	n / a	+	This question may be too specific for the survey sample.	N	N
Please rate the statement by checking a box between two opposite words: Living on this street makes me feel... 1 2 3 4 5 Angry <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> peaceful	+	-	+	n / a	+	This is a general question considering stress.	Y	Y
How is the quality of the air on this street? 7. Very good 8. Fairly good 9. Reasonable 10. Fairly poor 11. Very poor 12. Don't know, can't say	+	0	+	n / a	+	Air quality is problematic in Hanoi,	Y	Y

**Table 10. Survey question selection for stress, including noise and air pollution.**

Table 11 contains the survey question selection for social interaction.

Question	Practical	Objectivity	Explaining social interaction	Successful for Appleyard	Successful for Hanoi	Remarks	Question in survey	Question in MCA
In about how many households on this side of the street do you know people by sight? Count each household as one set of friends or relatives. (For example, acquaintances, friends, family) ____ (Write in numbers)	-	0	+	+	0	As people indicate, who they know it is reasonable objective, whereas the measurement of this question can take a lot of time and thinking for respondents.	Y	Y
In about how many households on the other side of the street do you know people by sight? Count each household as one set of friends or relatives. (For example, acquaintances, friends, family) ____ (Write in numbers)	-	0	+	+	0	As people indicate, who they know it is reasonable objective, whereas the measurement of this question can take a lot of time and thinking for respondents.	Y	Y
Please tell me how often, if at all, these activities go on here on your street, that is, in the street itself, the sidewalks and porch? Choose frequently, occasionally or don't. <ol style="list-style-type: none"> <li>1. Walking pets</li> <li>2. People talking</li> <li>3. Bike riding</li> <li>4. Gardening</li> <li>5. Car/motorcycle washing</li> <li>6. Playing with toys</li> <li>7. House painting</li> <li>8. Sitting outside</li> <li>9. Car/motorcycle repairing</li> <li>10. Parents supervising children</li> <li>11. Eating</li> <li>12. Badminton (exercise)</li> <li>13. Cooking</li> </ol>	0	0	+	0	0	Many activities can be conducted making the question difficult to measure, process and analyse.	Y	Y
Do you think your street is suitable for doing the activities listed in the previous question?	0	0	0	n/a	+	This could indicate whether activities are possible or not at a given street. If no activities are possible, social cohesion will expected to be lower.	Y	Y
Where do most of your <u>friends live</u> ? Would you say they live... <ol style="list-style-type: none"> <li>5. On this street</li> <li>6. In this ward of Hanoi, but not this street</li> <li>7. Elsewhere in Hanoi</li> <li>8. Outside Hanoi</li> </ol>	+	0	+	-	0	No clear relationship between traffic volume and the distance of friends follows from this question at the Appleyard study.	Y	Y
Where do most of your <u>family live</u> ? Would you say they live... <ol style="list-style-type: none"> <li>5. On this street</li> <li>6. In this ward of Hanoi, but not this street</li> <li>7. Elsewhere in Hanoi</li> <li>8. Outside Hanoi</li> </ol>	+	0	+	-	0	Analogue to previous question there is no clear relationship between traffic volume and the distance of family following from this question at the Appleyard study.	Y	Y
Please rate the statement by checking a box between two opposite words: Living on this street makes me feel...	+	0	+	0	+	When social activism is high residents are not expected to feel lonely on the street.	Y	Y

Question	Practical	Objectivity	Explaining social interaction	Successful for Appleyard	Successful for Hanoi	Remarks	Question in survey	Question in MCA
lonely	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	Not lonely		
Please, show where any friends, relatives and acquaintances live on this map of the street? Put an x-sign at every household. (SHOW MAP OF STREET BLOCK)	-	+	+	+	+	This is the drawing question, probably the most important question of Appleyard.	Y	N
Which have you ever done to bring about changes in your neighbourhood? 1. talked to neighbours 2. attending meetings 3. signed petition 4. wrote to public figure 5. wrote newsletter 6. drew up petition 7. voted for candidate 8. organised or joined action group 9. filed lawsuit 10. none	0	0	+	0	0	This is a simple question for interviewees, but it may be difficult to achieve a significant difference in analysing as participation in these forms of neighbourhood activism may be low everywhere.	N	N

Table 11. Survey question selection for social interaction.

Table 12 below contains the survey question selection for privacy and home territory.

Question	Practical	Objectivity	Explaining privacy and home territory	Successful for Appleyard	Successful for Hanoi	Remarks	Question in survey	Question in MCA
Which of the statements best describes how <u>responsible</u> you personally feel for the way the street looks and what happens on it (for example: keeping the street clean, safe, well maintained)? 1. Extremely responsible 2. Quite responsible 3. Somewhat responsible 4. Only slightly responsible 5. Not at all responsible 6. Don't know, can't say	+	0	+	+	+	An interesting question. People might dislike dirty streets, while many streets are not clean.	Y	Y
Which statement best describes how much this street feels like home to you? 7. I most definitely think of this street as home 8. I think of this street as home	+	0	+	n/a	+	This may be a good question to capture home territory and prepare respondents for the next question.	Y	Y

Question	Practical	Objectivity	Explaining privacy and home territory	Successful for Appleyard	Successful for Hanoi	Remarks	Question in survey	Question in MCA
9. Suppose I might consider this street as home 10. I don't think of this street as home 11. I would never think of this street as home 12. Don't know, can't say								
Some people feel that also the sidewalk or the street feels as part of their home. Which statement on this card best describes where <u>you feel your home extends?</u> (ALTERNATIVELY PHRASED: DO YOU FEEL AT HOME IN THE FOLLOWING AREAS?) 8. The whole block or more feels like home 9. This building and out into the street 10. Building and out into the sidewalk 11. Just the building 12. Just my own apartment/house 13. Other, (specify) _____ 14. Don't know, can't say 15.	-	0	+	+	+	The phrasing "how far your home extends" may be differently interpreted by different residents.	Y	Y
Which statement best describes the way the buildings and sidewalks are <u>kept up</u> by the people who live on the street? 6. Very well kept up 7. Fairly well kept up 8. Satisfactory 9. Not very well kept up 10. Not at all kept up	+	+	+	n/a	+	This is a relative objective question and may represent the indicator as cleaning the street can be result of a community in the street together.	Y	Y
Which statement best describes how often your privacy is disturbed by things that happen on this street (For example, traffic, crime, business)? 7. Very often 8. Quite often 9. Sometimes 10. Hardly ever 11. Never 12. Don't know, can't say	0	0	+	n/a	+	Clear question about privacy.	Y	Y
Which statement best describes the situation on this street and around your house with respect to <u>danger from crime</u> ? (For example, stealing, gangs, aggressive vendors) 7. Very safe 8. Quite safe 9. Neither safe, nor dangerous 10. Quite dangerous 11. Very dangerous 12. Don't know	+	0	0	+	+	The feeling of the existence of crime may also intrude the feeling of privacy. In the Appleyard survey people were more concerned about crime than traffic safety. This question enables comparing traffic safety with crime.	Y	Y
Which statement describes best how often you are aware of the traffic here on this street? 1. Very often 2. Quite often 3. Sometimes 4. Hardly ever	+	0	0	n/a	+	Awareness of traffic might influence privacy, but could also very well relate to stress.	N	N



Question	Practical	Objectivity	Explaining privacy and home territory	Successful for Appleyard	Successful for Hanoi	Remarks	Question in survey	Question in MCA
5. Never 6. Don't know, can't say								
Compared to the other streets in this area, how does your street look? 1. Very good 2. Fairly good 3. Reasonable 4. Fairly poor 5. Very poor 6. Don't know, can't say	+	0	+	n/a	0	It might be difficult to compare an abstract term as 'other street in this area' with their street for some respondents.	N	N
Would you like to change anything about the appearance of your street? What? (Open question_____)	0	+	0	n/a	+	In Hanoi and san Francisco local governance is said to be slow, while they are in control of the street appearance. Possibly people do not manage to change thing through this governmental body, or just take control themselves, without permission.	N	N

**Table 12. Survey question selection for privacy and home territory.**

Table 13 below contains the survey question selection for environmental awareness.

Question	Practical	Objectivity	Explaining environmental awareness	Successful for Appleyard	Successful for Hanoi	Remarks	Question in survey	Question in MCA
Could you make a sketch, map or drawing from your street? (PROVIDE A PENCIL AND EMPTY SHEET)  1. (DURING DRAWING: Are there some features or details you would like to add?) * 2. THE FOLLOWING PHRASES CAN BE USED TO COMFORT THE RESPONDENT 1. Just draw any way you like 2. You can sketch from above, or from the side 3. It is not about whether you are a good artist or not, but it is an important question for the research 4. There is no need to make a neatly sketch, a very rough sketch is perfect 5. You may at names to indicate what parts of the sketch represent	-	+	+	+	+	This is a drawing question, one of the most interesting questions of Appleyard. Though, drawing might be a threshold for respondents. Furthermore, as residents do not know this question is to see how much they know about their street environment, it might be difficult to conduct the drawing but results will be quite objective.	y	N

Question	Practical	Objectivity	Explaining environmental awareness	Successful for Appleyard	Successful for Hanoi	Remarks	Question in survey	Question in MCA
About how much time do you spend on this street, counting both the time inside and outdoors? Choose one: all, most, about half, little, or none. 1. Weekday during the day 2. Weekday during the evening 3. Weekends (Saturday and Sunday)	0	+	+	n/a	+	The more time you spend on the street, the better the environmental awareness.	Y	N

**Table 13. Survey question selection for environmental awareness.**

Table 14 below contains the survey question selection for mobility, considering motorised vehicle use and ownership.

Question	Practical	Objectivity	Explaining for mobility, considering motorised	Successful for Appleyard	Successful for Hanoi	Remarks	Question in survey	Question in MCA
What form of transportation do you use to: 1. Go shopping downtown 2. Get around the neighbourhood 3. Get to work 4. Visit friends in Hanoi 5. Visit friends elsewhere Choose: auto/motorcycle, transit/taxi, walking/bicycle	0	0	+	0	-	Appleyard did not find a significant difference in modal split for streets with differences in traffic volume, whereas the traffic counts of Hanoi suggest that the modal share of cycling increases when the traffic volume decreases (ALMEC Corporation, 2005).	N	N
Do you or other members of your household own a motorcycle, car, or truck? 3. Yes 4. No	+	0	+	0	-	This question is used to understand resident characteristics and therefore moved to the 'general'.	Y	N
During the past few weeks, what was the furthest distance you went from your home other than work? (km)	+	0	0	0	-	It is unclear what this question could tell us about travel patterns.	N	N
"What is the number of local trips you made yesterday to an activity within the neighbourhood?" (number)	+	0	+	0	n/a	Different respondents may interpret 'Local' and 'neighbourhood' differently.	N	N
"What were the purpose, length and mode of each of these trips? "(visit friends, go shopping, get around in neighbourhood, get to work; number of km; auto/motorcycle, transit/taxi, walk/bike) New	-	0	+	0	n/a	This question is time consuming and asks a lot of thinking of interviewees, but does hold a lot of information about local trips.	N	N

**Table 14. Survey question selection for mobility, considering motorised vehicle use and ownership.**

Table 15 below contains the survey question selection for other questions related to livability.

Question	Practical	Objectivity	Successful for Apleyard	Successful for Hanoi	Remarks	Question in survey
I feel that my street is...					The relation between if a street is 'planned' and 'livability' may be unclear. Second, attractive, interesting, colourful and beautiful are rather asking after a subjective than objective condition. However, these conditions are likely to indicate how people enjoy living on this street; an attractive street is likely to be a livable one.	
1. attractive/unattractive;	+	-	0	n/a		N
2. interesting/dull	+	-	0	n/a		N
3. colourful/drab	+	-	0	n/a		N
4. good looking houses/unattractive houses	+	0	0	n/a		N
5. beautiful street/ugly street	+	-	0	n/a		N
6. planned/unplanned	0	0	0	n/a		N
7. close, cramped/open, spacious	+	0	0	n/a		N
8. cold/warm	0	0	0	n/a		N
(scale of 5 degrees)						
Living on this street makes me feel...					Analogue to the previous questions these are subjective statements, still they will give an idea about the livability of the street.	
1. Happy/unhappy	+	-	0	n/a		Y
2. Ashamed/proud	+	-	0	n/a		Y
3. Lonely/not lonely	+	-	0	n/a		Y
4. Powerless/powerful	+	-	0	n/a		N
5. Contented/discontented	+	-	0	n/a		Y
6. Safe/unsafe	+	-	0	n/a		Y
7. Neglected/cared for	+	-	0	n/a		Y
8. Angry / peaceful	+	-	0	n/a		Y
Which of the statements on that card best describes your feelings all-in-all about living here on this street?	+	-	0		Interesting question for validation of survey.	Y
6. I'm very happy here						
7. I'm fairly happy here						
8. I'm neither happy, nor unhappy here						
9. I'm fairly unhappy here						
10. I'm very unhappy here						
Which statement on this card best describes your overall feeling about this street compared to other streets in this area of Hanoi?	+	0	+	+	Residents might have difficulty not to know with which other street to compare.	N
1. This is the best street in the area						
2. This street is better than average						
3. This street is about the same as most streets						
4. This street is worse than average						
5. This is the worst street in the area						
Was this street about as you expected it to be before you moved here, or is it better or worse than you expected?	+	0	n/a	+	Question considering history might be left out to limit the number of questions and to focus on the current street.	N
1. Much better than expected						
2. Fairly better than expected						
3. About as expected						
4. Fairly worse than expected						
5. Much worse than expected						
In what ways is it (better) (worse) than you expected?" (PROBE)	0	0	n/a	+	Remarks analogue to previous question.	N

Question	Practical	Objectivity	Successful for Apleyard	Successful for Hanoi	Remarks	Question in survey
Desired changes - "What would you like to change most of all?" (less traffic; add greenery; better maintenance; O.K. as it is; change street character; stop signs; local facilities; improve parking; change people)	0	+	+	+	Difficult question for analysing.	N
"If you had to describe your street; what are the first 4 or 5 things that come to your mind?": (Excessive traffic; people friendly; quite, not busy; conventional; dirt, litter; noisy; greenery; poor appearance, needs trees, paint; parking problems; traffic noise, pollution; traffic danger; no crime, vandals; clean, no litter; good terrain, climate, view; physical site, don't like people, kids; crime, vandals; poor terrain, climate; no traffic, no parking problem; inconvenient; general appearance)	0	0	+	+	Might be difficult for respondents.	N
If, for some reason, you had to move from here to some other street, which statement on this card best describes how you would feel about that? Why is that? 1. Very unhappy to move 2. Fairly unhappy to move 3. Nor happy nor unhappy to move 4. Fairly unhappy to move 5. Very unhappy to move	0	0	+	+	This question indicates if other things than the traffic is keeping them here and are therefore more important.	N

**Table 15.** Survey question selection for other questions related to livability.

Table 16 below contains the survey question selection for socio-demographic characteristics and preferences of residents.

Question	Practical	Objectivity	Successful for Appleyard	Successful for Hanoi	Remarks	Question in survey
In which of these types of places would you prefer to live if you had the choice? 1. open country, farm 2. small town 3. Outer suburbs 4. Inner suburb	0	0	0	+	This question helps identifying differences between residents of different types of streets. A person who lived most of his life in a small town, may see more drawbacks from the traffic than someone who has always lived in the inner suburb.	N
In which type of places have you spend most of your life? 1. open country, farm 2. small town 3. Outer suburbs 4. Inner suburb	0	+	0	0	Analoque to previous question.	N
How long have you lived here in this neighbourhood ____ (years)	+	+	0	+		Y
How long have you lived here in this house ____ (years)	+	+	+	+		Y
If, for some reason, you had to move from here to some other street, which statement on this card best describes how you would feel about that? Why is that? 1. Very unhappy to move 2. Fairly unhappy to move 3. Nor happy nor unhappy to move 4. Fairly unhappy to move 5. Very unhappy to move	0	0	0	+	This question can help understanding differences between residents at different street types. Residents choose between convenience and heavy traffic.	Y
If you had the choice of living on a busy street and getting to work, shopping and other places quickly or living on a secluded, quiet street and taking a long time to get where you 're going, which would you prefer? 1. Busy street 2. Quiet street 3. Makes no difference 4. Not sure, depends	+	+	n/a	+	Interesting dilemma for Hanoi residents.	Y
Below is a list of some things that are important to different people in deciding what street they want to live on in the city. For each one, please check how important or unimportant it is to you personally to have this. Choose one: Extremely important, Very important, rather important, or not at all important.  Schools close to home Convenient to downtown Convenient to work Near public transportation Parks and recreational facilities nearby	0	0	+	+	Preferences of residents might indicate whether residents are similar across street types.	Y

Question	Practical	Objectivity	Successful for Apleyard	Successful for Hanoi	Remarks	Question in survey
Clean, uncluttered Greenery: trees, grass and plantings along the street Peaceful and quiet, not noisy Good walking conditions Privacy  Space for sport and leisure activities on pedestrian area i.e. badminton, chatting Sociable, friendly people Good for children to play Pleasant view  Prestige of area Safe and secure from crime Safe and secure from traffic Cost of housing Minimal air pollution						
"Now, we don't care to know your exact income, but would you please look at this card and tell me into which of these groups your total family income falls (before taxes)?" (Under 10,000,000 VND; 10,000,000 – 39,999,999 VND; 40,000,000 – 69,999,999 VND; 70,000,000 or over; Refused, don't know)	+	+	0	+		Y
"Do you own or rent the house?" (own; rent)	+	+	+	+		Y
What is the occupation of the chief wage earner of this household?	0	+	0	0		Y
What is the current employment status of the chief wage earner? 1. Working part time 2. Working full time 3. retired	+	+	0	0		N
Including yourself, how many people are there in this household?	+	+	+	+		Y
What age are these people?	+	+	+	+		Y
Respondent's housing 8. Single family house, one story 9. Single family house, multiple story 10. Flat, apartment in 2 to 3 unit building 11. Flat, apartment in 4 to 9 unit building 12. Flat, apartment in 10 to 19 unit building 13. Flat, apartment in building with 20 or more units 14. Other (specify) _____	+	+	0	+		Y
Floor on which interview took place	+	+	0	0		Y

Question	Practical	Objectivity	Successful for Apleyard	Successful for Hanoi	Remarks	Question in survey
1. below street level 2. above street level						
How long do you think most people live here? ___(years)	+	0	0	0		N
Respondent's name						Y
Street address						Y
Time and date of interview						Y
Interviewer name						Y

**Table 16.** Survey question selection for socio-demographic characteristics and preferences of residents.