Internship Report

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Introduction

Supported by the Cameron Speth and the Class of 1964 Fellowships, I took up a summer internship at *EMBARQ*, the World Resources Institute Center for Transport and the Environment, working on its various Asia projects. This report is intended to summarize my work and the relevant deliverables, record the difficulties encountered and lessons learned, and make recommendations for continued work by others in the future.

Main Work

1. Established a transport indicator database for the three partner cities involved in the Project on Sustainable Urban Transport in Asia (PSUTA), namely, Hanoi (Vietnam), Pune (India), and Xi'an (China), and summarized the existing data into this database.
2. Established a transport indicator database including indicators in the areas of infrastructure, access, safety and environment -- in the same format as the PSUTA database described above, for fifteen major Chinese cities, and filled in data wherever information could be found.
3. Co-authored a paper on PSUTA titled "Indicators: Reliable Signposts on the Road to Sustainable Transportation -- the Partnership for Sustainable Urban Transport in Asia" for the Transportation Research Board of the National Research Council in the National Academy of Sciences, with research results from the indicator database developed for PSUTA.
4. Drafted a proposal for an international transport indicator database based on the PSUTA experience and for further efforts beyond PSUTA.

Deliverables

1. PSUTA database (saved in .05 - tools/Urban Trans Database/UrbanTransDatabase_in progress/PSUTA+Shanghai database.xls)

   (1) Database structure

   This database includes five main categories of transport indicators – people & places, transport, access, safety, and health & environment. Under each category, there are a few indicators with relevant units. These indicators are used to measure the performance of the urban transport system in its many aspects.

(2) Selection of indicators

There are five general categories of indicators as be discussed below:

1) People & Places	DoD*	Rationale
Population	E	Demand for public transport
City area	E	Area of coverage required of transportation system
Population Density	E	Demand for public transport
Population growth rate	M	Expected future demand for public transport
GDP per capita	E	City's overall economic productivity and resources
Income per capita	M	Household financial resources

2) Infrastructure	DoD	Rationale
Total road length	E	
Area of paved roads	D	
Rail length	E	
Road area/total urban area	M	Capacity of the current transport system
Rail passenger capacity	E	
Bus network length	E	
Parking capacity	M	
# motor-vehicles (by categories and ownership)	E/M	Pressure on the transport system and most recent trends in growth of motor-vehicles
Average vehicle mileage	D	The degree to which vehicles are utilized; these could indirectly be used for emission purposes.
Average passenger mileage	D	
Transport investment	M	A measure of local government's willingness to transportation infrastructure building, as well as room for future growth
Household expenditure	D	Impact of transport on household budget and daily life
Trips modal share	E	Identify the transportation means most often used

3) Access	DoD	Rationale
Congestion	D	Time lost in traffic, which could otherwise be used for work, leisure, etc. → efficiency of the system
Travel speed	D	
Population w/in 500 m	D	Portion of the population with public transportation readily available in the adjacent neighborhood
Daily time use	M	Frequency of transport activities and demand
Equality of access	D	Equality of access of men and women, of higher and lower income groups, to various transport modes

4) Safety	DoD	Rationale
Number of accidents	M	
Traffic fatalities (Total)	E	Direct negative externalities of unsafe urban transport systems

5) Health & Environment	DoD	Rationale
Pollutants	M	Concentrations of NOx, SOx, CO, HC, VOC and CO2, as well as the fraction from the transport system -- including both ambient concentration and traffic concentration -- cost to

* Degree of Difficulty in retrieving the data for a certain indicator: D (difficult), M (medium), E(easy).

Pollution related deaths	D	public health from the transport system
Level of noise	M	Cost to the living and working environment of citizens in the city from the transport system.

Please see Appendix I for a complete database indicator list.

(3) Observations & Lessons

While compiling the data from PSUTA city reports, some key issues are uncovered:

a) Many areas of the established database for all three PSUTA cities still remain blank – these are the very areas that need to be addressed in future data collection work. In a few areas, such as number of total motor vehicles, cars, public buses, and two-wheelers, time-series data for many years in the 1990s and early 2000s are available and demonstrate clear trends. The challenge, however, is to find similar time-series data for the access, safety and environmental indicators, which can be correlated to the transportation. Environmental pollution monitoring, in particular, has not been delicately managed in the three cities – improvement in this area, if the policy-makers can identify this gap and decide to act on it, can lead to positive changes in the city's general environmental quality control system.

b) Definitions of terms can be ambiguous, which can hurt the basic credibility of an indicator. For example, even among Chinese experts, a "car" ("汽车") can mean different things because of the ambiguities of the two characters in Chinese. In all three cities, boundary lines between urban areas and the "greater metropolitan" area are often uncertain, affecting population, vehicle, and pollution data in scale. Furthermore, definitions for such simple concepts as "trips" may also vary. Hence any database must give very clear definitions and explain how these differ from city to city. This is to give researchers and officials – be them local or international – have a clear sense of how the key concepts are defined.

c) Transparency is another key element contributing to the credibility of a comprehensive database, yet based on the PSUTA reports we have obtained from EMBARQ partners, there are often data that look quite dubious yet we have no way of knowing how the data are retrieved and derived and what methods are used for calculation, interpolation and/or extrapolation. For instance, some cities have an "ambient air quality index" with average concentrations of various pollutants listed; however, it is often unclear how the index is calculated or how the listed concentrations are derived. In other words, the users and developers must know exactly what the data mean. Without transparency, tables filled with numbers are no more useful than blank tables.

d) Also due to the differences in data collection among the three countries, the types of data available are rather inconsistent across the PSUTA cities. While some cities may do very well in summarizing data in certain areas, another city could have blanks for the same areas. This, however, creates an opportunity for cities in different countries to learn from each other. One consistent area of difficulty, however, does exist -- namely, access indicators

such as congestion (time lost in traffic), 500-meter-radius population, gender equity, and income equity; none of the PSUTA cities have reported data in these areas, and it is very possible that nobody has ever done any research or survey related to these indicators.

e) Other existing databases, such as the ones developed by the UITP, Jane's Urban Transport Systems, as well as the World Bank's transport research group, do not cover the scope that the PSUTA indicator database has done – namely, linking issues like pollution and safety closely to urban transport and integrating urban transport into overall city-planning. For example, Jane's Urban Transport Systems does not deal with air quality or safety, and the World Bank's research group, as its lead advisor Peter Roberts has said, has not done much work on urban transport, with most of its efforts focused on national highways and inter-city transportation. The UITP database is also rather crude in that it lacks the transparency and clear definition discussed earlier.

f) Some time-series comparison and analysis were done whenever data are available. Aside from the "master database" tag in the file, a separate worksheet tagged "PSUTA time series" was created, with the vehicle numbers from all three PSUTA cities in time-series from 1990 to 2004. Clear trends are shown in these tables and the derived graphs; this demonstrates that when a database is well-kept, it can be very useful for research analysis.

(3) Recommendations

a) The PSUTA city reports contain large quantities of data that can feed into the indicator database. However, it has been found that there are occasional conflicting information. For example, some data on past PowerPoint presentations have differed from draft reports submitted by cities, in which case, we generally rely on the reports.

b) Some data might not be very clear as to how they are retrieved, in which case getting in touch with our partners in the PSUTA cities are very helpful, either via phone calls or emails. Phone calls are especially helpful for clarification of methodologies. For instance, I found some data on how much noise came from traffic, yet we were not clear how the percentage was calculated. A phone call with Mao Zhong'an, our partner in Xi'an, confirmed that there was no scientific, systematic methods at this point and therefore we should not rely on the data. Getting directly in touch with partners has also been helpful in regard to point a) above, i.e. solving data discrepancies in separate reports. Two of our Pune partners submitted different reports that contained different vehicle numbers, and an email request received a very prompt reply on how each of their data should be used as well as the sources of the data, offering the due transparency.

2. Transport indicator database for fifteen Chinese cities (saved in .05 - tools/Urban Trans Database/UrbanTransDatabase_in progress/15 Chinese cities database.xls)

(1) Database structure & indicators

This is an expansion of the PSUTA+Shanghai database into fifteen Chinese cities, with the same indicators. These cities include: Beijing, Changsha, Chengdu, Chongqing, Dalian, Hangzhou, Guangzhou, Kunming, Nanjing, Shanghai, Shenyang, Shenzhen, Tianjin, Wuhan, and Xi'an. These cities were chosen because of their the sizes of their populations, economies, and vehicle fleet. In fact, these metropolitan areas possess majority of motor-vehicles in China.

This nation-wide database can offer a more comprehensive picture of the transport situation in the given nation's urban areas. This will also enable the mayors to compare with other cities in the same country and see their own strengths and weaknesses.

Please see Appendix II for the indicator list.

(2) Observations & Lessons

a) While some of the data are available in annually published municipal statistical yearbooks, others are either never taken or did not make the way into the yearbooks. The gap in the indicator database for major cities can inform city officials what types of data are needed in order for them to make more informed decisions to promote sustainable transport. As a test, fifteen major Chinese cities were chosen and placed in the same indicator database established for PSUTA cities. It is found that most Chinese cities are rather consistent in what types of data are summarized into official statistical yearbooks, and these data are often available in times-series as well. On the other hand, the data that are unavailable for one city are often not present in most other cities simply because the statistical bureaus and other agencies were never instructed to do so, creating a nation-wide gap.
b) While searching for available data, it is observed that many Chinese government agencies have moved the platform for information sharing to the Internet and more and more data are now present not just on city, provincial, and national statistical bureaus' websites, but also on each implementation agency's own website, which specializes and goes into more details in each area. For example, most big cities' environmental protection bureaus produce daily air quality monitoring results and publish monthly and/or annual pollution reports, including, but not limited to, SO_2, CO, NO_2, PM, and noise level, many of which are not present in the general statistical yearbooks. As this database is not yet complete, more agency information sources can be used to identify the real gaps.

   Please see Appendix III for a list of websites that I have used to obtain some of the data.
c) One challenge in using some of the data, including the pollution data mentioned above is to figure out how they are retrieved and what methods are used. This relates to the transparency theme in indicators. For example, environmental protection bureaus (EPB) have all produced an overall noise level, which, as users of the data, we are not sure of its origin; furthermore, some EPBs also gave a percentage point for noise from traffic alone by the level of intensity – this is a very interesting number and we certainly would

like to use it, but again, the method by which they generated this percentage contribution from traffic is unknown. Until these methodologies become transparent, the data collected would have very limited meanings.

(3) Recommendations

Aside from city statistic yearbooks, there are many other sources of information, e.g. Environmental Protection Bureaus(环保局), Traffic Management Team (交通队). And since some cities' statistic bureaus do not yet have all their yearbooks online, it might be advisable to make some purchases of municipal yearbooks to facilitate the completion of this database.

3. Paper on PSUTA to the Transportation Research Board (TRB) of the National Research Council for its 2006 meeting (saved in 05.tools/ADB project - PSUTA/Articles-Papers/psuta_trb_2006.doc)

- Researched for and utilized the "PSUTA+Shanghai" indicator database set up earlier to make graphs and tables for this paper submission, including:
  - Growth of vehicle ownership in the three PSUTA cities
  - Current motor-vehicle quantities by types of vehicles (cars, buses, 2-wheelers, trucks, etc.)
  - Trips modal share: what transportation means people use to commute (private cars, buses, rail, 2-wheelers, non-motor)
- Edited and proof-read the final version of the paper before formal submission to the TRB.

ABSTRACT:

"We describe a collaborative effort with leaders of three middle-sized cities in Asia to build indicators of sustainable transport. These indicators should demonstrate the present state and direction of the transport system, the key driving forces (economic activity), important characteristics of the system that affect its sustainability, including provision of access to economic and personal activities, safety, and air quality affected by transportation activities. The indicators also measure the economic health of the transport industry and infrastructure itself.

"The partner cities were Pune (India), Hanoi (Viet Nam) and Xi'an (China). The objective was not to get a complete set of data and indicators, many of which would be costly to obtain. The goals instead were to identify key problems in transportation, to see what authorities did or did not know about problems with transportation, map this gap of information required to address the problems in a cost-effective way, bridge the gaps of information required for indicators, and cross the bridge with good policies. Fortunately, some important quantitative indicators did emerge. Many of these painted a grim picture of unsustainable transport.

"We give some quantitative examples illustrating some of the results from the three cities, and put forward our key recommendations for filling the gaps. We conclude that by our indicators, access is getting worse, clean air is getting scarcer, and safety is not improving very rapidly in the PSUTA cities. Measures could change these indicators and make transport more sustainable, which we hope our engagement will have stimulated."

4. Draft on current PSUTA status and potential project opportunities (saved in 05.tools/Urban Trans Database/UrbanTransDatabase_in progress/Asia Indicator Database Summary.doc, and Asia Indicator Database Summary_2.doc)

   The second version, after being revised according to the suggestions from others, has included more content on the advantages of a comprehensive indicator database and explores beyond the PSUTA project. It is written as a draft proposal for possible future funding sources.

   - Objective:
     "Establishing a comprehensive transport indicator database based on the PSUTA experience, extending the influence to more cities at the regional and national levels, and initiating partnerships with parties who both know about the technical issues involved in indicators and have influence over government decision-making."

APPENDIX I

Category	Sub-category	Indicator	Unit
PEOPLE & PLACES	Population & Area	Population: Metropolitan	millions
		Urban	millions
		Surburban/rural	millions
		City area: Metropolitan	
		urban	sq km
		Surburban/rural	sq km
		Pop. density: Metropolitan	per sq km
		Urban	per sq km
		Surburban/rural	per sq km
		Population growth rate	%
	Individual	GDP per capita	USD or local
		Income per capita	
TRANSPORT	Infrastructure	Total road length	km
		Paved roads	% of total
		Rail length	km
		Road area	sq km
		Road area/total urban area	%
		Rail passenger capacity	per hour
		Parking capacity	ratio, area
		Bus network length	km
	Motor Vehicles	Total number	
		cars (small-passenger)	
		buses	
		trucks	
		taxis	
		2-wheelers	
	Owernship	Private	#
		Company	
		Government	
	Transport Activities	Vehicle mileage	km
		Passenger mileage	km
		Transport investment	million $
		Household expenditure	$
		Modal shares: car	%
		bus	%
		taxi	%
		2-wheelers	%
		non-motor	%
	Transport Conditions	Congestion	time loss
			road congested
		Travel speed: peak	

		off-peak	
ACCESS TO TRANSPORT	Access	Population w/in 500 m Daily time use Equality of access male female low-income high-income	% min # or % % % %
SAFETY	Accidents	Number of accidents Traffic fatalities (Total) non-motor motor	 %
HEALTH & ENVIRONMENT	Pollutants	NO x concentration % related to transport SO x concentration % related to transport CO concentration % related to transport HC concentration % related to transport PM10 or 2.5 VOC concentration % related to transport CO2 Level of noise	 % mg/m^3 tons Db A
	Health Effect	Pollution related deaths	

APPENDIX II

Category	Indicator	Unit	Beijing
People & Places			
Population & Area	Population*: Metropolitan	millions	10.67
	Urban		
	City area*: Metropolitan	sq km	12,484
	Urban		
	Pop. Density: Metropolitan	per sq km	855
	Urban		
	Population natural growth rate	%	
Individual	GDP per capita*	yuan RMB	29,283
	Income per capita Rural		
	Urban		10,286
Transport			
Infrastructure	Paved roads （城建环保/市政设施）	km	
	Rail length	km	
	Paved road area*	sq km	74.94
	Sidewalk area (市政设施）	sq km	
	Rail passenger capacity	per day	

	Parking capacity	ratio, area	
	Bus network length （城建环保/城市公交）	km	
Motor Vehicles	Total number	units	17,580
	car (small-passeenge)	units	
	bus		
	truck	units	
	taxi		
	2-wheelers	units	
Owernship	Private	#	
	Company		
	Government		
Transport Activities	Vehicle mileage	km	684.36
	Passenger mileage	km	
	Transport investment	million $	
	Household expenditure*	$	
	Modal shares: car	%	
	bus	%	
	taxi	%	
	2-wheelers	%	
	non-motor	%	
Access to Transport			
Transport Conditions	Congestion	time loss road congested	
	Travel speed: peak		
	off-peak		
Access	Population w/in 500 m	%	
	Daily time use	min	
	Equality of access		
	male	# or %	
	female	%	
	low-income	%	
	high-income	%	
Safety			
Accidents	Number of accidents		
	Traffic fatalities (Total)		
	non-motor	%	
	motor	%	
Health & Environment			
Pollution	NO x concentration	mg/m^3	0.076
	% related to transport	%	
	SO x concentration	mg/m^3	0.067
	% related to transport		
	CO concentration	mg/m^3	2.5
	% related to transport		
	HC concentration		
	% related to transport		
	PM-10	mg/m^3	0.166
	VOC concentration		
	% related to transport		
	CO2	tons	

	Level of traffic noise (城建环保）	Db A	68.5
	Overall city noise	Db A	54.1(2)
Health Effect	Pollution related deaths		

APPENDIX III

Yearbook of China's Cities (2003) and own calculation

** 小型汽车 "smaller vehicles" -- assumed to be cars

(1) of which 32% from traffic, Tianjin Environmental Protection Report 2002, http://www.tjhb.gov.cn/article.asp?id=696

(2) Beijing envir report: http://www.bjepb.gov.cn/news/2004-4/2004427154622.htm

(3) Chongqing envir report: http://www.cepb.gov.cn/hjgb/2002_04.html

(4) Hangzhou envir report: http://www.hzepb.gov.cn/20031216/gongbao2002/shj1.htm

(5) of which 16.2% from traffic, Wuhan envir report: http://www.whepb.gov.cn/huanbao/communique.asp?fileid=6&filepath=communiquepath. Also included is the percentage of population living in areas with 60 or less noise level

(6) Derived from graphic data on Hunan envir report: http://www.hbj.hunan.gov.cn/manager/HJGB/20031231.htm

(7) Guangzhou envir report: http://www.gz.gov.cn/egov/rdzt/gzcm/gjhbmocs/200408020014.asp

(8) of which 47% from traffic, Kunming envr report: http://www.kmepb.gov.cn/enviroment/2002/4.htm

(9) Nanjing envir report: http://www.njhb.gov.cn/hjzl/2002gb.htm

(10) Shenzhen envir report: http://www.szems.gov.cn/hjgg/sz-2002.htm

(11) SO2/NO2/Noise data from Shanghai envir report: http://www.envir.online.sh.cn/law/bulletin/b2003/contents.htm

(12) Shenyang & Dalian SO2/PM10 2003 data in Liaoning provincial envir report: http://www.lnepb.gov.cn/look.asp?id={122A4F16-0336-4646-8AAA-2FE7A86C99F8}