2. TRANSPORT ISSUES

In order to identify the present transport characteristics as well as forecast future demand, the following 15 types of traffic counts and interviews were carried out in the Study Area from May through August in 2000.

Traffic Survey Items and Contents

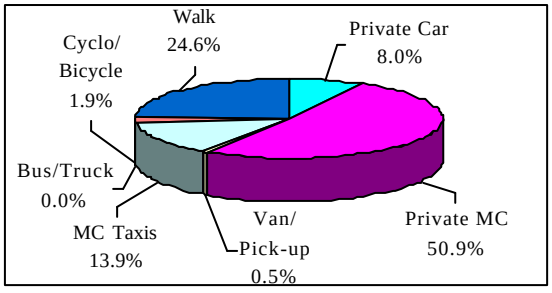
•Person-Trip Interview (Household, Personnel, OD)		6,000 Households
•Cordon Line (Traffic Counts & OD Interview)		8 stations (24 & 15 hr)
•Screen Line (Traffic Counts)		9 stations (15 hr)
•Roadside Traffic Volume (Traffic Counts)		33 stations (24 & 15 hr)
•Intersection Traffic Movement (Traffic Counts)		8 stations (14 hr)
•Travel Speed (Floating Car Method)		9 routes (3 x 3 times)
•Commodity Movement (Company & Terminal Interview)		30 companies 3 terminals
•Parking Condition (Interview & Counts)		8 blocks (2-hr x 3)
•Terminal Traffic (Traffic Counts)		5 terminals (14 hr)
•Passenger Interview	Inter-Regional	3 terminals (300 sample)
	Taxi-Bus	5 terminals (300 sample)
	Para-Transit	5 terminals (600 sample)
•Owner & Driver Interview	Taxi-Bus	5 terminals (100 sample)
	Para-Transit	5 terminals (500 sample)
	Private Car & Bike	12 stations (1500 sample)

(1) Transport Characteristics

Transport Mode

The transport in the Study Area is characterized by a high share rate of "private motorcycles" and "motorcycle taxis" (motodop & motorumok), accounting for 64.8% of all transport modes, or 88.3% of motorized vehicles.

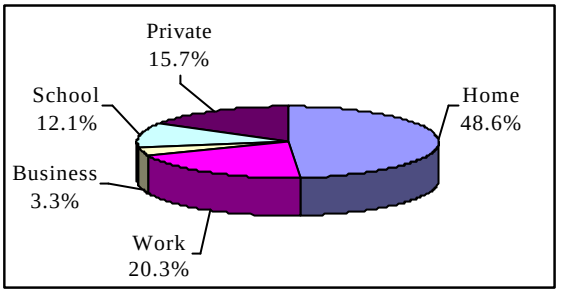
Trip Composition by Transport Mode



Walk trip has a 24.6% share, which is the second highest, while light vehicles, such as "passenger car" and "van/pickup", have only 8.5% share of the total.

Trip Purpose

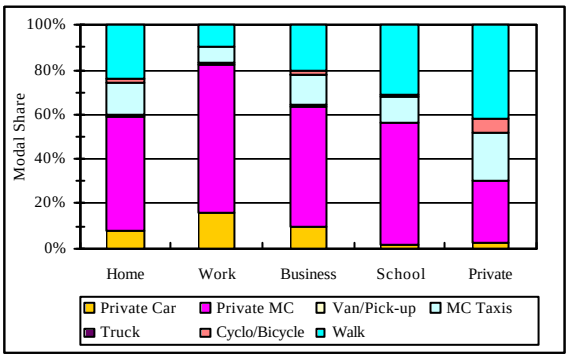
"Go to work", "private" and "go to school" are the major purposes of trip, accounting for 20.3%, 15.7% and 12.1% respectively, aside from "go home" occupying about 49%.



Trip Composition by Trip Purpose

Mode Choice by Trip Purpose

"Private motorcycles" occupies the highest share for all purposes of trip, except for "private" trips for which "walk" exceeds the "private motorcycles". The "private motorcycles" share is the highest in "go to work" trips followed by that in "go to school" trips, accounting for 65.9% and 54.6%, respectively.



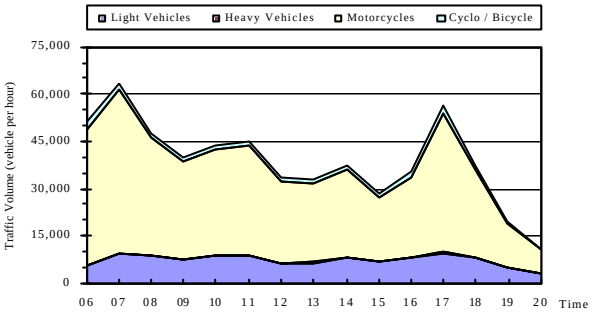
Transport Mode by Trip Purpose

Traffic Volume and Conditions

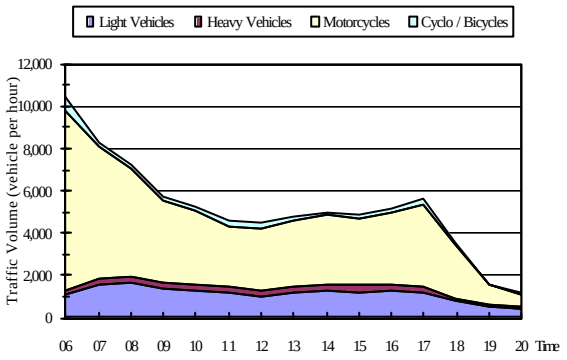
Total traffic volume crossing screen-line and cordon-line is around 520,000 and 70,000 vehicles per daytime 12-hour (6:00~18:00) with average 24/12-hr ratio of 1.23 and 1.20, respectively.

At screen-line stations, intra-city trips show two high peaks in the morning and before evening as well as two other relatively high peaks before and after lunchtime, while at cordon-line stations,

inter-city trips show high peak in the early morning and relatively high peak before evening with average heavy vehicles share of around 5%. Most of those peaks both intra-city and inter-city trips are mainly generated by the motorcycle-related traffic that shares 77% and 70% in average at screen-line and cordon-line stations, respectively.



Trip Composition by Time and Mode (Screen Line)



Trip Composition by Time and Mode (Cordon Line)

Two circular roads, such as Mao Tse Toung and Sihanouk Boulevards, are the arterial streets that handle the highest traffic volume as much as 10,000 vehicles per hour during the peak hour, followed by several radial roads, such as Monivong and Russian Boulevards that handle as much as 7,000 to 8,600 vehicles per hour.

Most of those arterial streets in the urbanized area have average travel speeds of around 20 to 30 km/hr, while Charles de Gaulle and Monireth Boulevard has average travel speed of less than 20 km/hr due to relatively poor surface conditions.

Streets near the city super markets or fruit markets and restaurants have low level-of-service, primarily due to widespread on-street and/or on-sidewalk parking. In addition, some of the intersections and roundabouts in the urbanized area also show low level-of-service due to improper traffic signal sequence arrangements and/or excess traffic volume, especially during the peak hours.

(2) Demand Forecast

Conventional four-step sequential method incorporated with disagrregate model to rectify the mode choice is applied in this Study through the use of JICA STRADA tools.

Based on the present OD matrix estimated through the accumulated person-trip data and established socio-economic framework, future generated and attracted trips was forecasted by applying multiple linear regression models.

Generated and attracted trips were distributed on zonal basis to produce future OD matrixes that were assigned on the modified functional road network on STRADA tools in order to identify the magnitude of potential transport problems in the future and to establish required transport improvement components of the Master Plan projects up to the target year 2015.

Trip Production

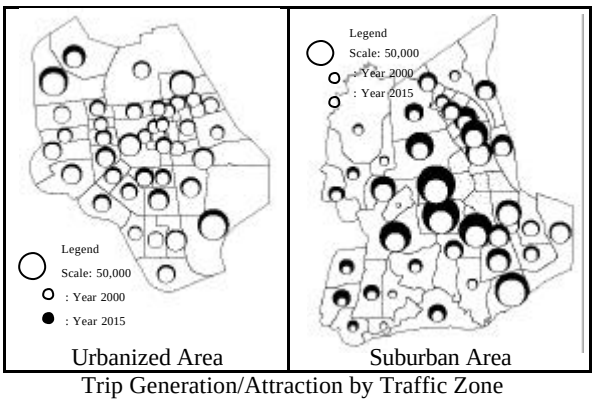
Trip productions rate calculated through person-trip, commodity movement, and cordon-line survey as well as supplemental private vehicle owner-driver interview were summarized as follows:

Trip Production Rate and Total Trip Production

Category	Mode	Rate	Trips
Internal Trip	Average	2.35	3,240
	Private Car	2.98	
	Private MC	2.59	
	Motodop/Motorumok	2.13	
	Cyclo/Bicycle	1.85	
	Walk	1.99	
External Trip	(Vehicle) x (Average Occupancy) = 85 thousand x 4.70		400
Cargo Trip	Van/Pickup/Truck	1.15	23

Unit of Trips: Thousand Person-Trip

Trip Generation and Attraction



Trip Generation/Attraction by Traffic Zone

Trip generation and attraction from/to suburban area will be expected to increase significantly due to proposed development plan. On the other hand, those from/to urbanized area are expected to increase moderately due to proposed regulation in land-use.

Trip Distribution

Inter-zonal model as well as intra-zonal trip model was formulated through STRADA tools. Trip ends within urbanized area or suburban area (inner trip) comprises more than 80% of all trips generated from and/or attracted to each area.

Inner trip rate by district base within urbanized area are ranged from 35 to 50%, while which within suburban area are ranged from 65 to 80%.

The trips generated inside the urbanized area account for 57.6% of all trips generated in the whole Study Area. This percentage is estimated to decrease to 47.7% in 2015, reflecting the development of suburban area.

Present and Future OD (2015/2000)

O \ D	Urbanized Area	Suburban Area	Study Area Total
Urbanized Area	2,080/1,266 (1.64)	525/298 (1.76)	2,605/1,564 (1.67)
Suburban Area	451/312 (1.45)	2,325/1,366 (1.70)	2,776/1,678 (1.66)
Study Area Total	2,530/1,577 (1.60)	2,850/1,664 (1.71)	5,381/3,241 (1.66)

Unit: Thousand Person-Trip per Day

Modal Split and Mode Choice

The share of private car will increase according to the growth of the economy, while share of private motorcycle may increase, if car ownership is limited, or decrease, and ownership shift from car to motorcycle occurs. Share of other mode, such as motorcycle taxi and/or bus, will depend on the policy decision, regulation, and so on.

Followings are estimated modal share of proposed four alternative scenarios. Alternative 1, 2, 3, and 4 are "Present Pattern", "Car Priority", "Bus Priority", and "Bus Favored," respectively.

Urbanized Area　　Suburban Area

Desire Line, 2015

Present and Future Modal Share by Alternatives

	Private Car	Private MC	Motodop/ Motorumok	Bus	Van / Pickup
Present	10.9	69.4	18.9	0.0	0.8
Alt. 1	17.5	63.0	18.7	0.0	0.8
Alt. 2	25.1	62.4	11.7	0.0	0.8
Alt. 3	17.2	62.1	0.0	20.0	0.7
Alt. 4	17.2	62.3	11.4	8.4	0.7

Unit: percentage in total, except cyclo, bicycle, and walk

Public Transport Demand

Analysis of public transport criteria through person-trip and public experiment surveys indicates that public transport demand will be a dependent variable of its fare and waiting time, hence operation intervals. However, longer waiting time causes much substantial decrease of demand than its higher fare setting. Followings is a sensitivity analysis of the public transport demand against various fare and waiting time combinations for the proposed bus system.

Public Transport Demand by Fare and Waiting Time

Waiting Time / Fare in Riel	5.0 min.	7.5 min.	10.0 min.
250	41.8	17.2	9.1
500	16.6	6.8	3.6
750	9.7	4.0	2.1
1,000	6.6	2.7	1.4
1,250	4.9	2.0	1.1
1,500	3.9	1.6	0.8

Unit: percentage of bus ridership within the accessible area

Traffic Assignment (Present & Future)

Followings are based on the results of traffic assignment through STRADA tools.

Present and Future Vehicle Trip

Mode	2000 (A)	2015 (B)	B/A
Private Car	124,730	317,465	2.55
Private MC	1,138,765	1,718,525	1.51
Van/Pickup	21,130	51,070	2.42
Motodop/rumoks	344,495	567,190	1.65
Bus	265	540	2.04
Truck & Trailer	14,300	38,845	2.72
Cyclo/Bicycle	45,275	74,690	1.65
Total	1,688,960	2,768,325	1.64
Walk	800,495	1,328,995	1.66

Unit: vehicle-trip per day

Person Trips by Trip Mode and Purpose

	2000		2015	
	Trips	%	Trips	%
Total	3,240	100.0	5,380	100.0
Mode				
Private Car	259	8.0	689	12.8
Private MC	1,649	50.9	2,488	46.2
Van/Pickup	19	0.6	32	0.6
Motodop/rumoks	450	13.9	739	13.7
Cyclo/Bicycle	65	2.0	108	2.0
Walk	797	24.6	1,325	24.6
Purpose				
Home	1,576	48.6	2,616	48.6
Work	659	20.3	1,112	20.7
Business	105	3.3	168	3.1
School	391	12.1	627	11.6
Private	510	15.7	858	15.9

Unit: thousand person-trip per day

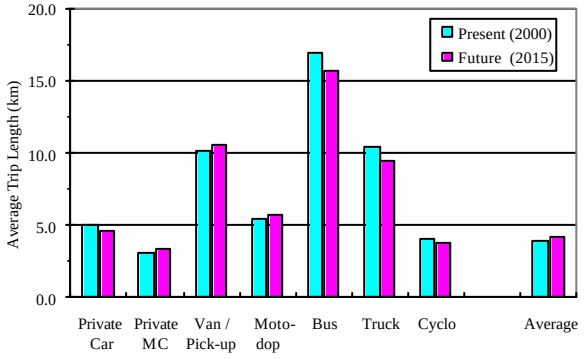
Average Trip Length

Average trip length is quite short, amounting to 3.9 km in 2000 and estimated to slightly lengthen to 4.2 km in 2015, if no counter measures are taken.

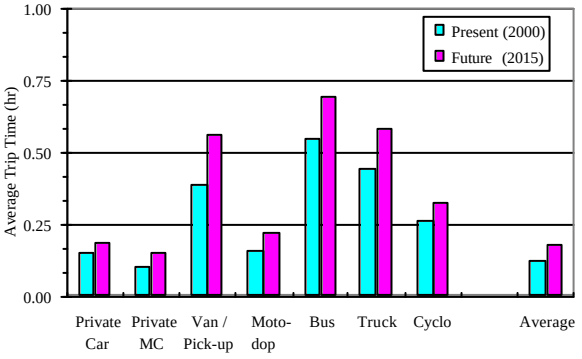
Average Trip Time

Average trip time is 0.13 hours in 2000 and estimated to lengthen to 0.18 hours in 2015, if no counter measures are taken.

Average Trip Length (2000 & 2015)



Average Trip Time (2000 & 2015)



Assigned Traffic

"Do Nothing Case" here reflects the case where no road improvement measures are taken following 15 years and traffic will increase rapidly according to the growth of the economy as described in the previous section.

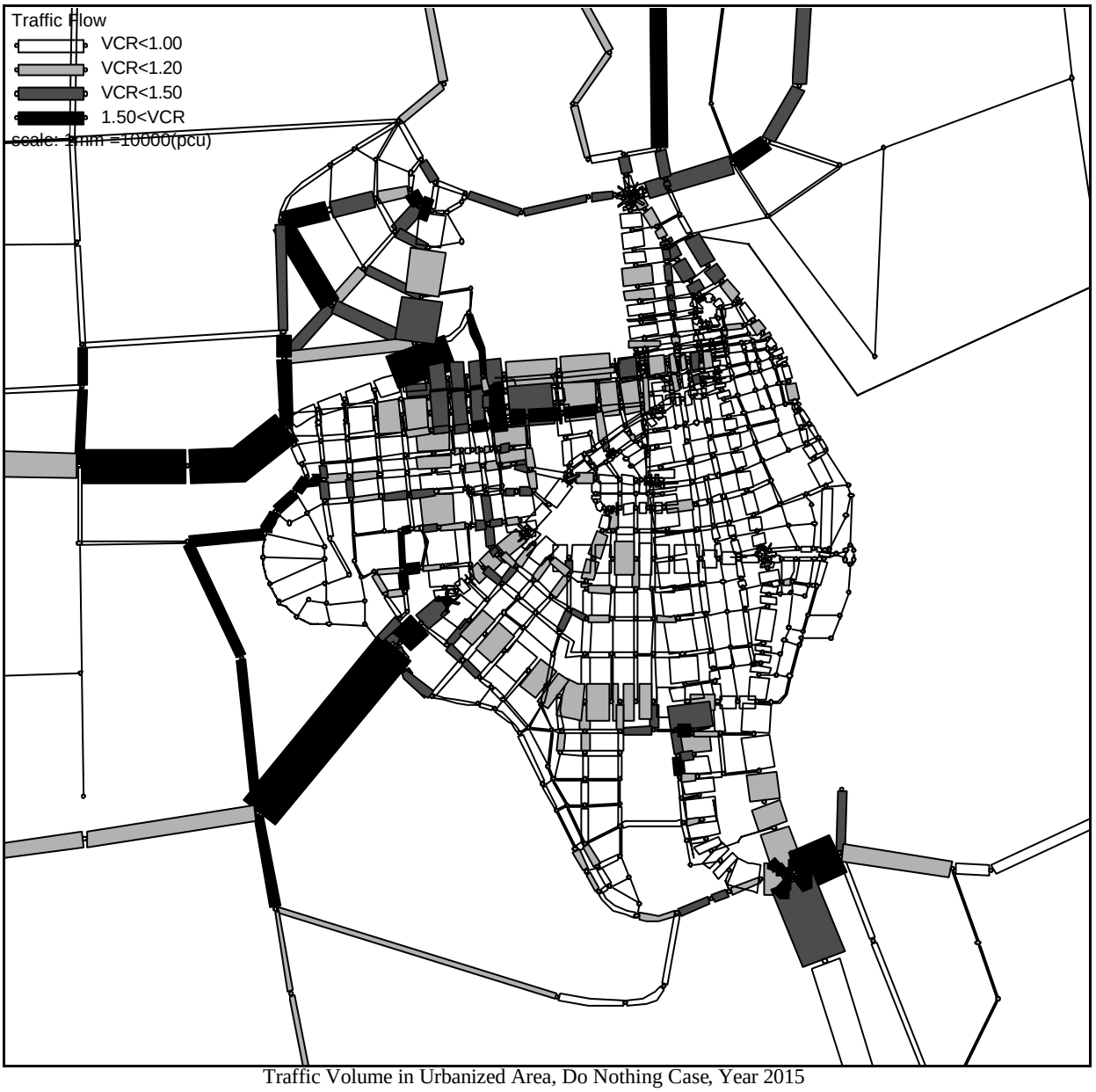
Urbanized Area

Traffic demand issues are as follows:

- Heavy congestion occurs mainly on the arterials.
- Function of the city is seriously affected by the congestion.
- Furthermore, the sound urban development is hindered and limited.
- The urban environment deteriorates due to traffic pollution.

Major causes of the congestion are as follows:

- The surface condition of collectors and local streets are very poor. Most of them are not fully utilized because of the condition.
- Therefore, traffic concentrates on arterials, which are not functioning efficiently because of congestion.
- Ineffective intersection operation aggravates the congestion, in particular the poor management of the mixed traffic of 4 and 2-wheel vehicles.



Traffic Volume in Urbanized Area, Do Nothing Case, Year 2015
(VCR : Volume / Capacity Ratio)

Suburban Area

Traffic demand issues are as follows:

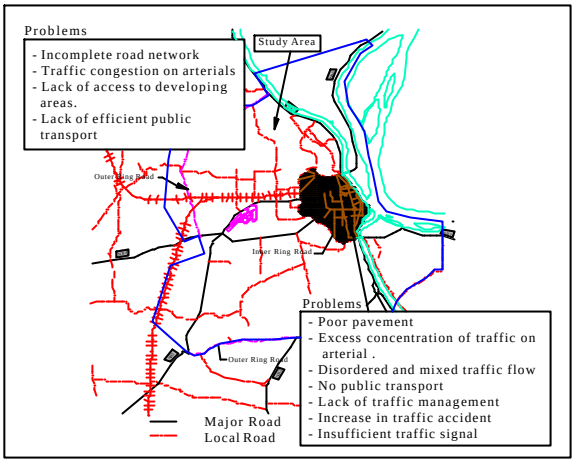
- Heavy congestion occurs in all arterials, especially at entries of the urbanized area.
- Exchange of people and goods between the urbanized area and suburban/rural areas is hindered.
- The development plan of Phnom Penh to locate industrial areas, new international airport, satellite city, etc. in and around the suburban area is arrested.
- The roadside environment deteriorates due to traffic pollution.

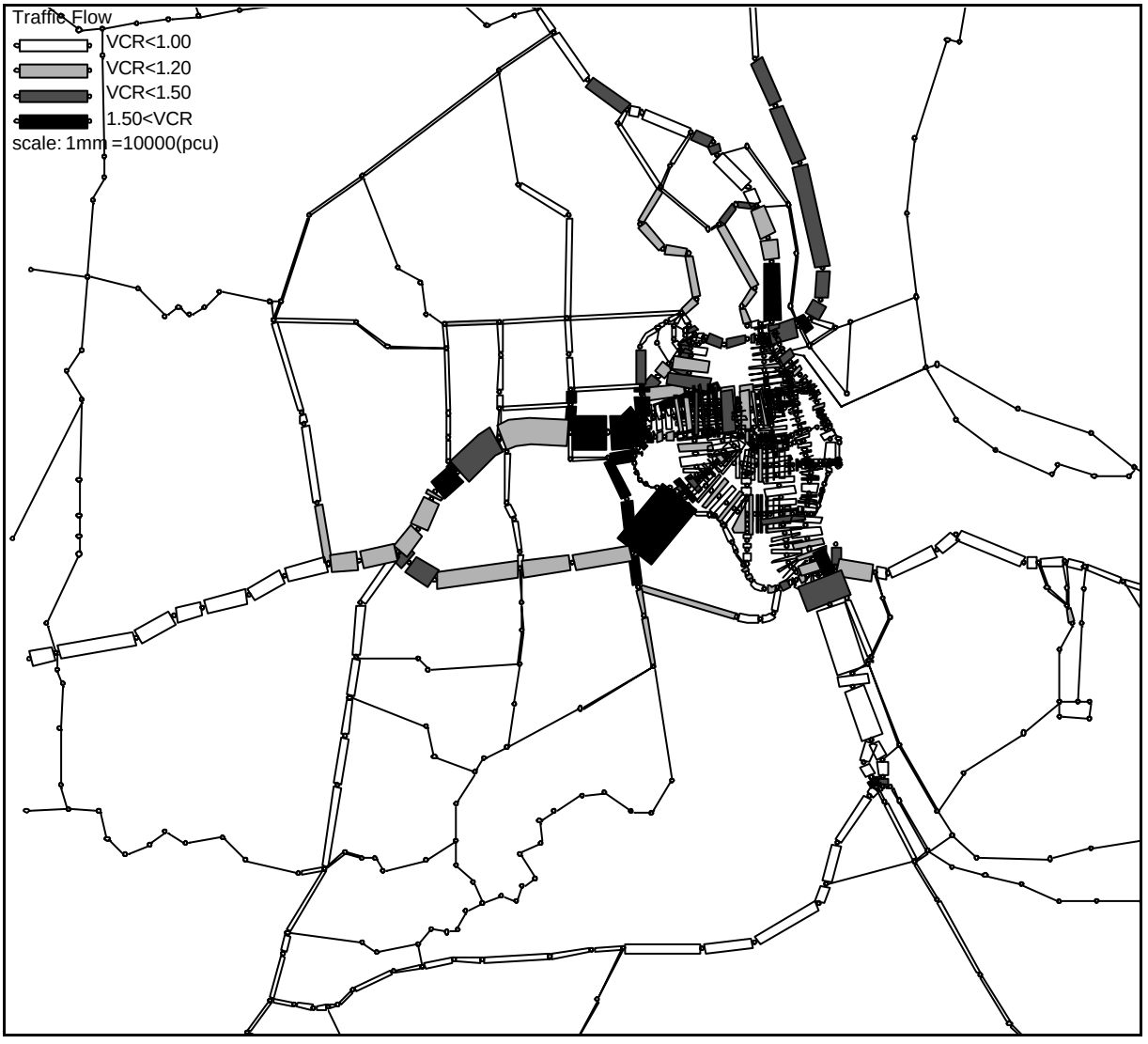
Major causes of the congestion are as follows:

- The road network is incomplete.
- Collector/distributor roads are lacking.

Typical Transport Issues in Urbanized and Suburban Areas

Typical issues are summarized by area.





Traffic Volume in Suburban Area, Do Nothing Case, Year 2015