



TRIP GENERATION

USING MALAYSIAN TRIP GENERATION
MANUAL (MTGM) 2010

(HIGHWAY PLANNING DIVISION,
MINISTRY OF WORKS MALAYSIA)

Mohd Fikri bin Hassan
Bahagian Kejuruteraan Trafik
Cawangan Jalan
JKR Malaysia
(17 Oktober 2019)

OVERVIEW OF TRIP GENERATION STUDIES

Trip Generation Phase I (Pilot Study)

Ranhill Bersekutu Sdn. Bhd.

Data collection commenced in 1995 (212 sites)

1st edition of MTGM published in 1997

Manual lacks data sufficiency

Did not truly reflect Malaysian trip behaviour (small data range, etc)

However, it laid the framework for subsequent studies (land use types/definition, data collection methods)

Trip Generation Phase II

Collaborators: USM Civil Engineering and Perunding Atur

Data enrichment phase (296 additional sites)

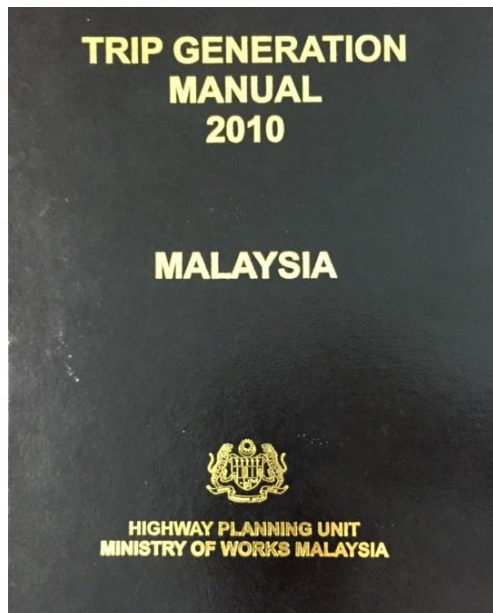
2nd edition of the Malaysian Trip Generation Manual published in year 2000

Trip Generation Phase III

School of Civil Engineering, USM as the sole consultant
315 new sites from 9 land use types and 105 subcategories
3rd Edition MTGM published in year 2005

Trip Generation Phase IV

Sole consultant: School of Civil Engineering, USM
278 new sites and 77 resurveyed sites to enhance manual accuracy
4th Edition MTGM published in year 2010



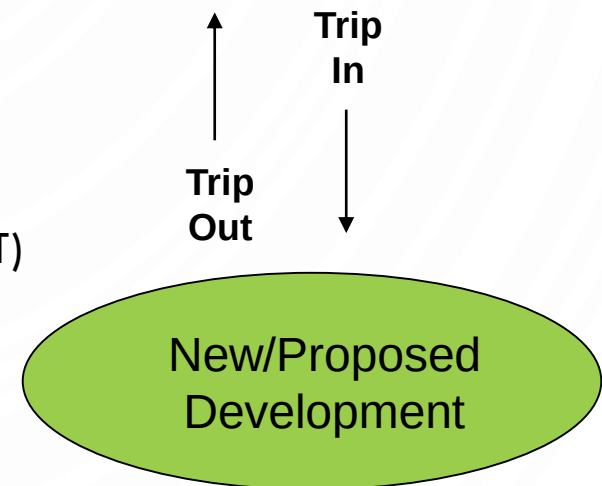
OBJECTIVE

- Enables practitioners/consultants to make an estimate of vehicular traffic that will be generated by a particular land use type
- Assist local authorities and other government agencies in the decision making of future land use planning involving the traffic system.
- Environmental assessment: Traffic impacts on air and noise
- Impact fee determination

OBJECTIVE

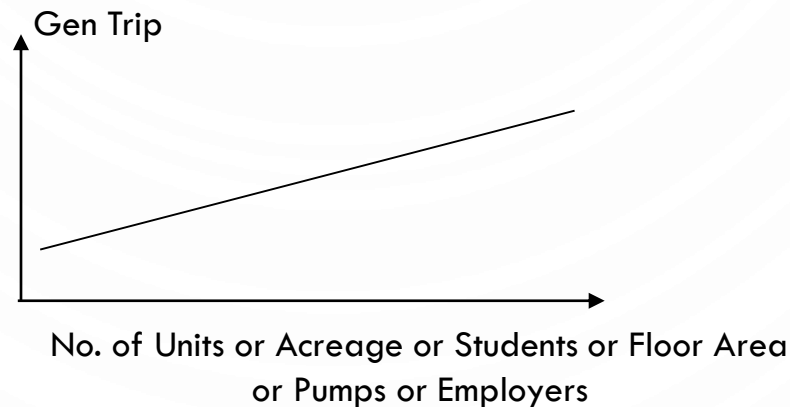
- To estimate the INGRESS and EGRESS trip that would be expected to be generated by a new/proposed development or expansion of an existing project during the peak hour
- Generated traffic is divided into trip attraction (IN) and trip production (OUT)

*Generated Ingress Trip = Trip Attraction (IN)
Generated Egress Trip = Trip Production (OUT)



BASIS

- Trip Generation Manual 2010 (HPD, KKR)
- Traffic Count : Collect data on existing ingress, egress trip of developments.
- Weekdays: Monday – Thursday ;
Weekend: Saturday- Sunday
- Data is plotted to produce a regression equation / multiplier factor
- Then, used to estimate generated trips



IMPORTANT TERMS

- **Peak Hour:** Highest one-hour flow of traffic during a defined period. It is defined by the highest volume of consecutive counts (ie: 7.30-8.30am) rather than clock-hour (7-8am)
- **Commuter Peak:** when commuter traffic (traffic flows on a street adjacent to a survey site) is highest.
 - AM: 7.00am-10.00am
 - PM: 4.00pm-7.00pm
- **Generator Peak:** when traffic entering and exiting a site is highest. It may or may not correspond to the peak period of adjacent street.
 - AM: before noon
 - PM: afternoon

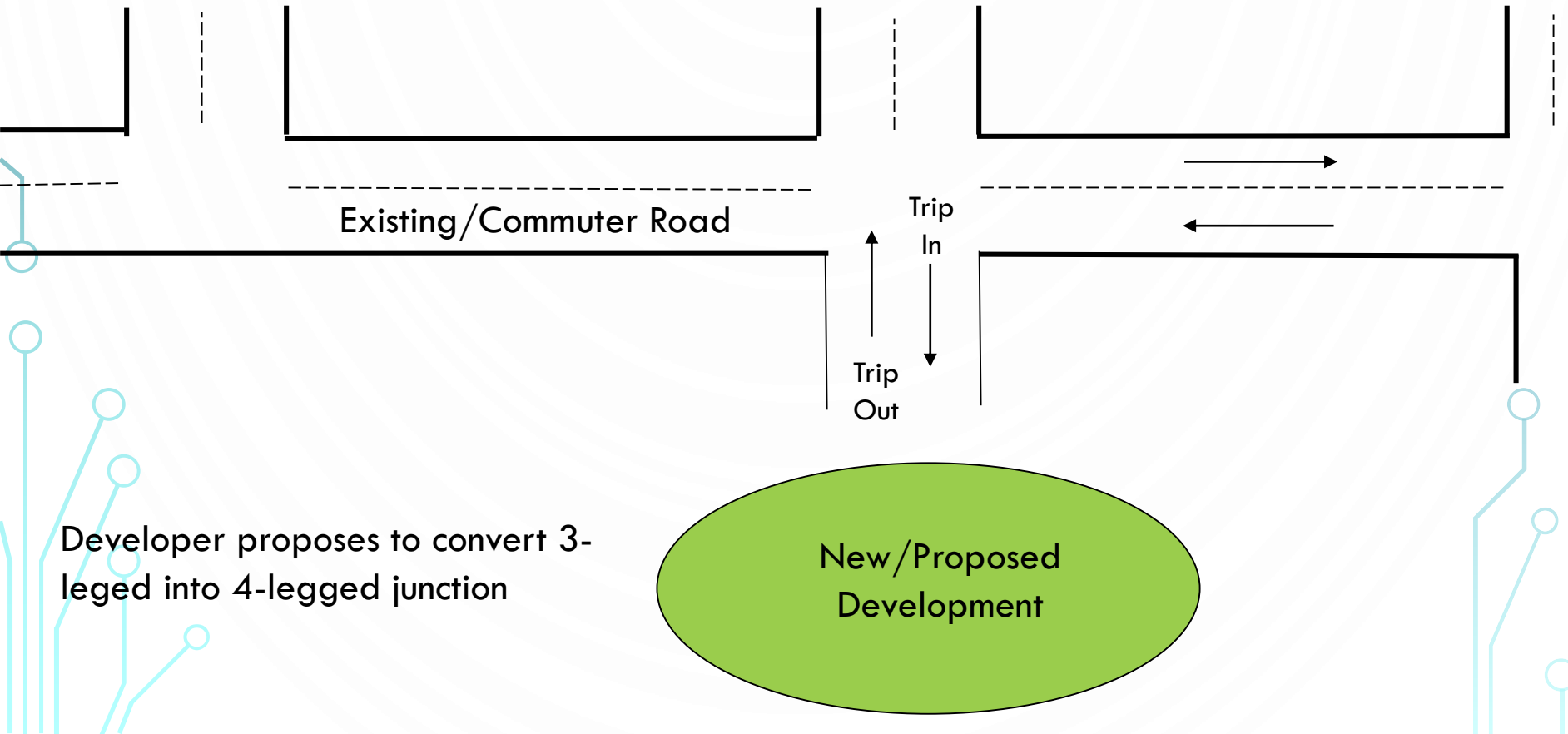
WHY MTGM

Generated trip also impact road link (study area).

May require upgrading from single to dual carriageway.

If developer lacks financial resources, advice to scale down development so that level of generated trips just sufficient not to exceed existing road capacity.

But new junction still required



PASSENGER CAR UNIT (PCU)

- PCU: a measure of the impact of a vehicle on the capacity of a road, measured as an equivalent number of passenger cars.
- PCU factor used in the manual:

Vehicle Type	PCU factor
Car / Taxi	1.00
Van	1.00
Light Lorry (2 axles)	1.75
Heavy Lorry (>2 axles)	2.25
Bus	2.25
Motorcycle	0.33

TIA TRIGGER LEVEL

No.	Criteria	Trigger Levels
1.	Peak Hour Trip Generation (Commuter peak)	150 added vehicles per hour (2-Way)
2.	Off-Peak Hour Trip Generation (Generator peak occurs at the off-peak period)	200 added vehicles per hour (2-way)
3.	Size of residential development	200 dwelling units
4.	Size of Commercial development	45,000 sq.ft. (gross floor area)
5.	Requirement of Approving Authority	May impose specific trigger levels as deemed necessary

CATEGORIES OF LAND USE

- Residential
- Institutional
- Religious
- Educational
- Burial
- Community Facilities and Recreational
- Commercial
- Industrial
- Agriculture / Forestry / Fishery
- Terminals

LAND USE TYPES

Major land use

Residential

Sub-categories

Terrace & Link, Town House

Semi-Detached, Detached

Flat, Apartment, Condominium

Low Cost Housing

Site & Services

Institutional Quarters

Institutional

Government Office Complex

Syariah, Magistrate, Session, High Court, Court Complex

General, Referral, Specialist, Nuclues, District, Private Hospital

Polyclinic, Government Health Centre, Clinic

Police Station

Police Field Force

Fire Station

Research Centre, Training Centre

Public Library

LAND USE TYPES

Major land use	Sub-categories
Religious	Mosque Surau, Madrasah Church
Educational	University & College, Private University & College, Teachers College Polytechnic Primary School Secondary School Private - Combined Primary and Secondary
Burial	Cemetery & Memorial Park Crematorium
Community	National & State, Public, Botanical Parks, Open Space, Playground, Recreational Forest Public Beach Sport Complex, Clubs, Tennis, Squash Court Centre, Badminton Halls, Public Swimming Pool Golf Course Stadium Polo Ground, Horse Race Track & Turf Club, Racing Track Amusement Park, Zoo, Aquarium, Bird Park, Science Park Community Hall

DATA SHEET FORMAT

- There are 5 graphs shown for each sub-category:

- AM Peak Hour of Commuter
 - PM Peak Hour of Commuter
 - AM Peak Hour of Generator
 - PM Peak Hour of Generator
 - Daily Trip Generation
- } In one page
- } In one page

- Each graph shows:
 - A plot of surveyed data points
 - A best fitted linear regression equation
 - A weighted average linear rate equation
- Average rate or regression equation?
- Parameter(s):
 - No. of Sites
 - Percent In/Out
 - Average Rate
 - Regression Equation
 - R-squared
 - PCU Conversion Factor

EXAMPLES OF DATA SHEET

Malaysian Trip Generation Manual

Highway Planning Unit
Ministry of Works Malaysia

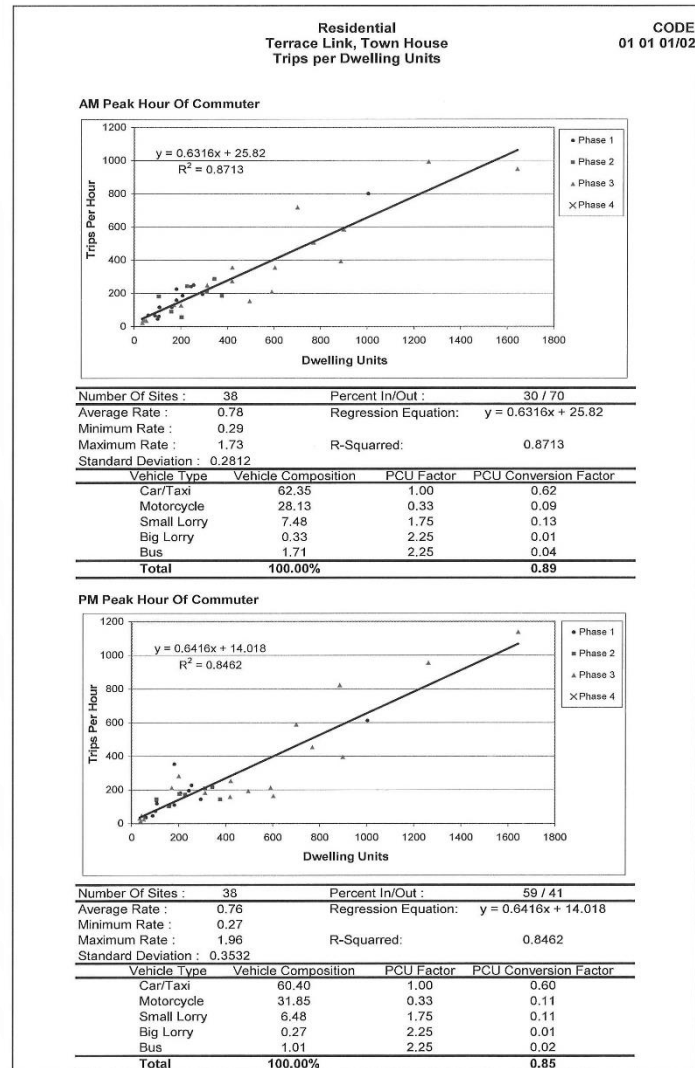


Figure 1-2(a): Example of Summary Sheet (Peak Hour of Commuter)

Malaysian Trip Generation Manual

Highway Planning Unit
Ministry of Works Malaysia

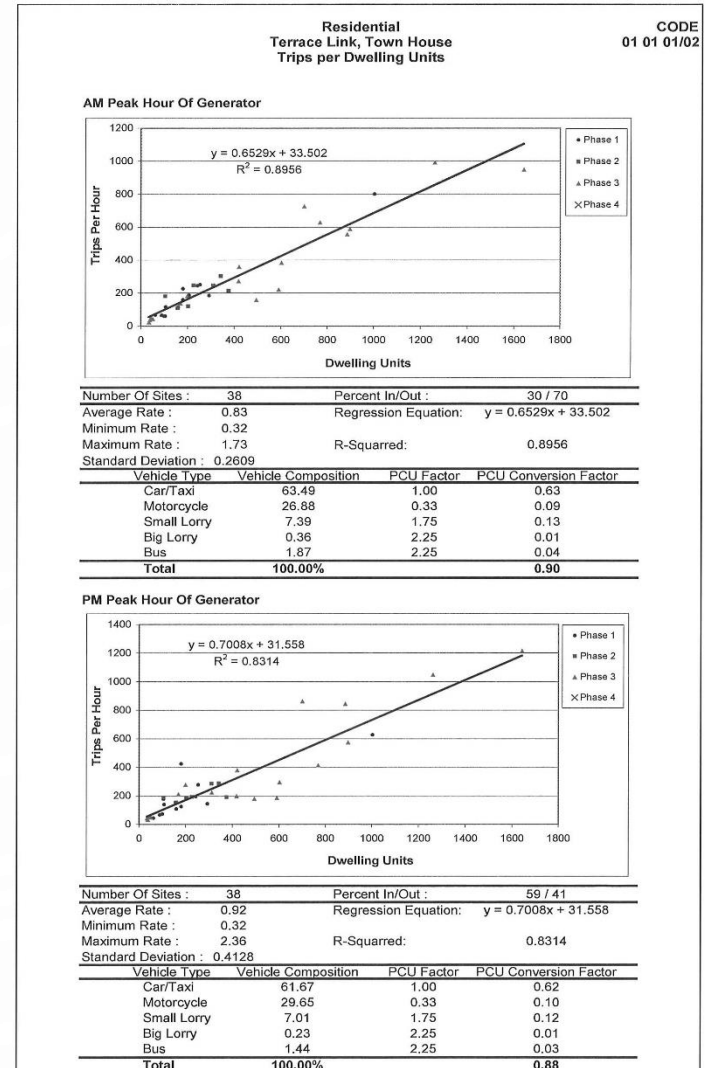


Figure 1-2(b): Example of Summary Sheet (Peak Hour of Generator)

EXAMPLES OF DATA SHEET

Malaysian Trip Generation Manual

Highway Planning Unit
Ministry of Works Malaysia

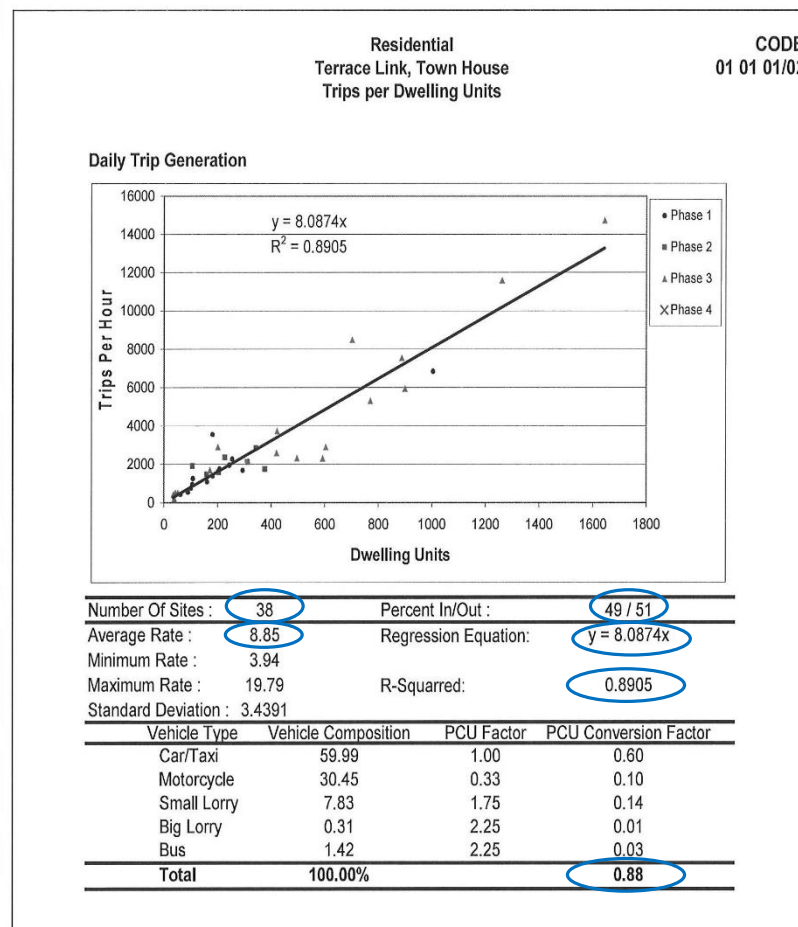


Figure 1-2(c): Example of Summary Sheet (Daily Trip)

STEP BY STEP

Identify the appropriate land use category

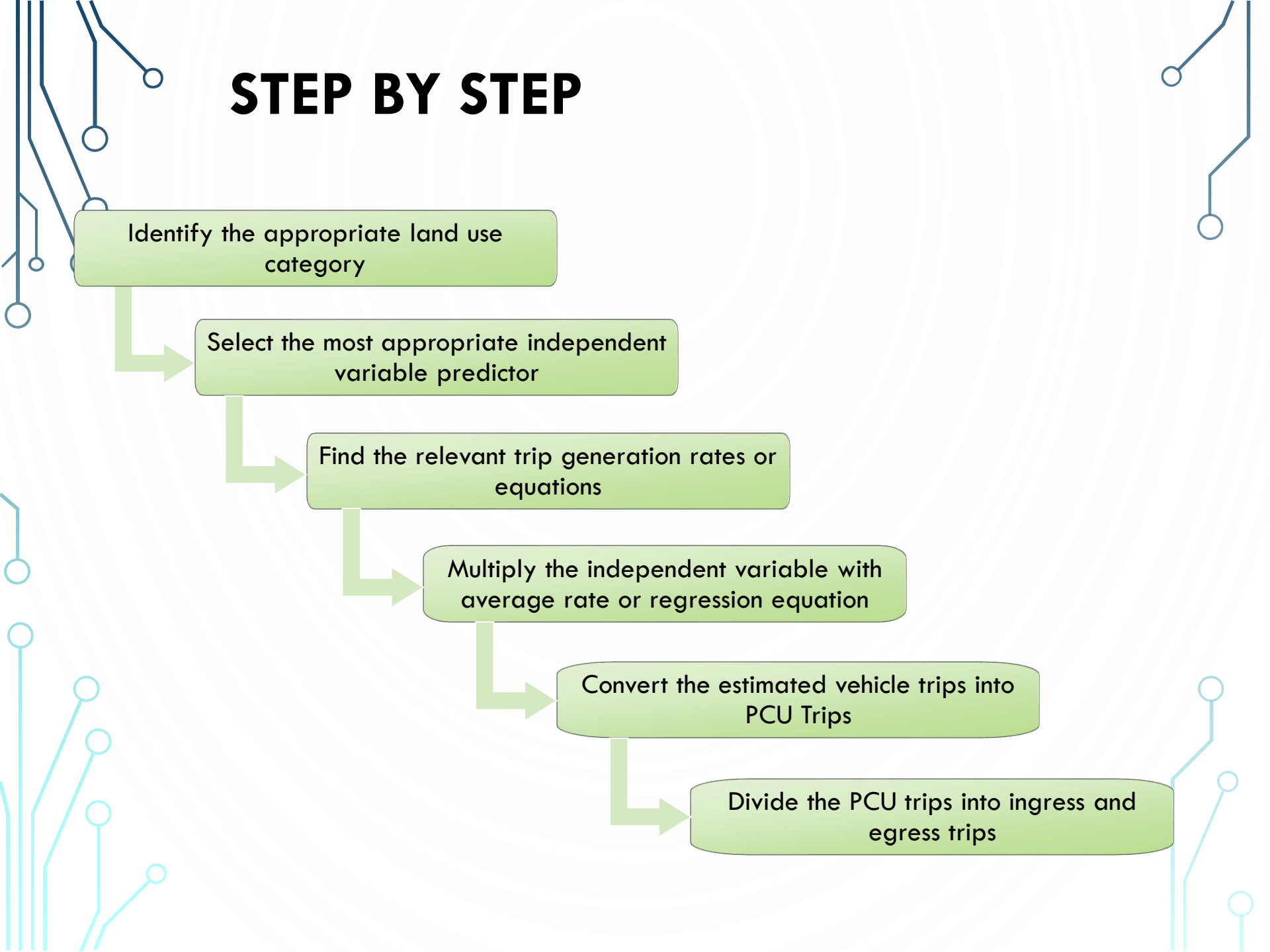
Select the most appropriate independent variable predictor

Find the relevant trip generation rates or equations

Multiply the independent variable with average rate or regression equation

Convert the estimated vehicle trips into PCU Trips

Divide the PCU trips into ingress and egress trips



STEP 1: IDENTIFY THE APPROPRIATE LAND USE CATEGORY

- Land use categories, sub categories and codes (after identifying land use type - Section 3)

le: Detached

- Major group – Residential (01)
- Minor group – Housing (01)
- Unit group – Detached (04)
- Code: 01 01 04

- Explanation of land use in detail (Section 4)

le: Detached: Detached Houses are free standing single buildings on individual lots. Recommended minimum lot size per unit is 50ft by 80ft with a range of 4,000ft² to ½ acre more. Detached houses are generally one or two storey structures.

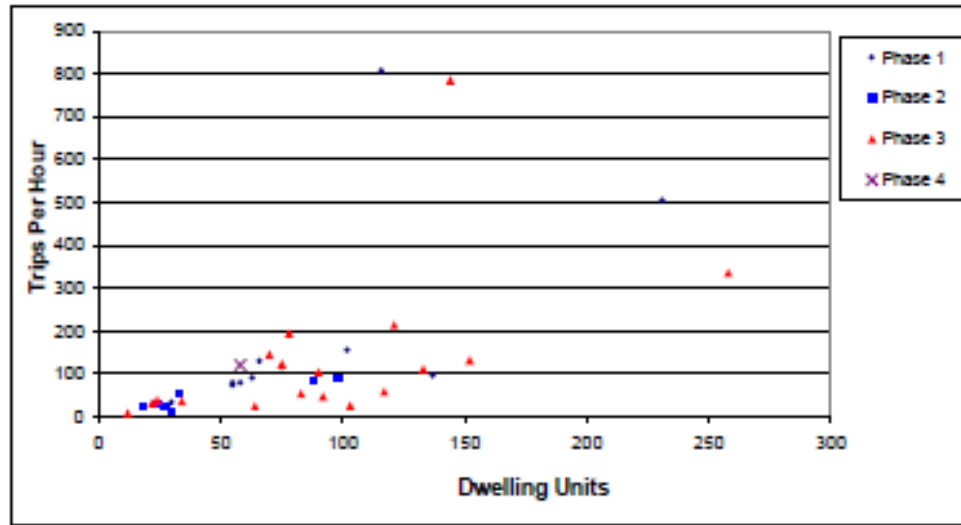
*It is important to check section 4 for details when there is a confusion / dispute in land use description.

le: Serviced Apartment

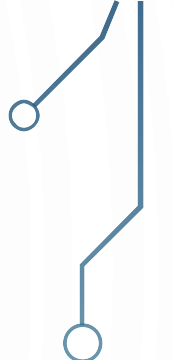
Residential Semi-Detached, Detached Trips per Dwelling Units

CODE
01 01 03/04

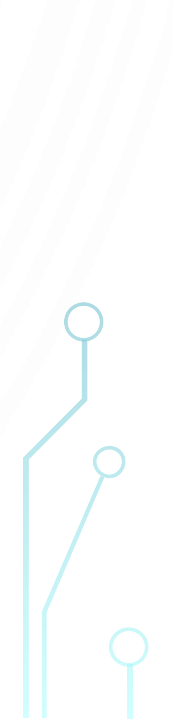
AM Peak Hour Of Commuter



Number Of Sites :	37	Percent In/Out :	35 / 65
Average Rate :	1.51	Use Trip Rates	
Minimum Rate :	0.25		
Maximum Rate :	6.96		
Standard Deviation :	1.2732		
Vehicle Type	Vehicle Composition	PCU Factor	PCU Conversion Factor
Car/Taxi	76.94	1.00	0.77
Motorcycle	15.11	0.33	0.05
Small Lorry	6.68	1.75	0.12
Big Lorry	0.02	2.25	0.00
Bus	1.24	2.25	0.03
Total	100.00%		0.96



STEP 2: APPROPRIATE INDEPENDENT VARIABLE PREDICTOR

- Example: Area (Thousand Square Foot), number of occupied beds, number of employees, dwelling units and etc.
 - Check R^2 value or standard deviation to choose the best variable, when there are more than once choice. Higher value is preferable.
 - If the proposed development is only described in one term and not in other variable, best to use an already available variable rather than converting to other variable.
- 
- 

SELECTION OF INDEPENDENT VARIABLE

Land Use	Category	Independent Variables
Commercial	Office Complex	Thousand Square Feet (TSF), Acre, Number of Employees
	Shop House	Thousand Square Feet (TSF), Acre
	Retail Premises	Thousand Square Feet (TSF), Acre, Number of Employees
Institutional	Government Offices	Thousand Square Feet (TSF), Acre, Number of Staffs
	Medical Services	Thousand Square Feet (TSF), Acre, Number of Beds, Number of Doctors
Residential	Housing	Number of Dwelling Units
Community Facilities	Sport Facilities	Thousand Square Feet (TSF), Number of Courts, Acre, Number of Seats, Number of Visitors
Educational	Tertiary Education	Thousand Square Feet (TSF), Acre, Number of Students
	Secondary Education	
	Primary Education	

STEP 3: RELEVANT TRIP GENERATION RATE OR EQUATION

- Depending on the purpose of analysis, decide whether to use Peak hour of COMMUTER, Peak hour of GENERATOR or Daily Trip Generation.
- TIA: Peak hour of Commuter.
- Rate/Equation?
- Use Regression Equation When:
 - The data plots has at least three points
 - $R^2 \geq 0.5$
 - A regression equation is provided
- Use Average Rate When:
 - At least there is a data point
 - $R^2 < 0.5$
 - No equation provided

SELECTION OF TIME PERIOD

Depends on purpose of TIA

Select relevant trip generation rates or equations from:

- AM commuter peak
- PM commuter peak
 - Will give the estimated generated trips for the land use DURING THE TIME PERIOD **when the adjacent main road is at its peak**
- AM generator peak
- PM generator peak
 - Will give the estimated trip generation for the land use DURING THE TIME PERIOD **when the land use trip generation is at peak**
- Daily rate
 - Will give the total generated trips for the land use for 16 hours of a day
- Weekday/Weekend trips (for shopping complex, shop house, shop office, hypermarket, fast food)

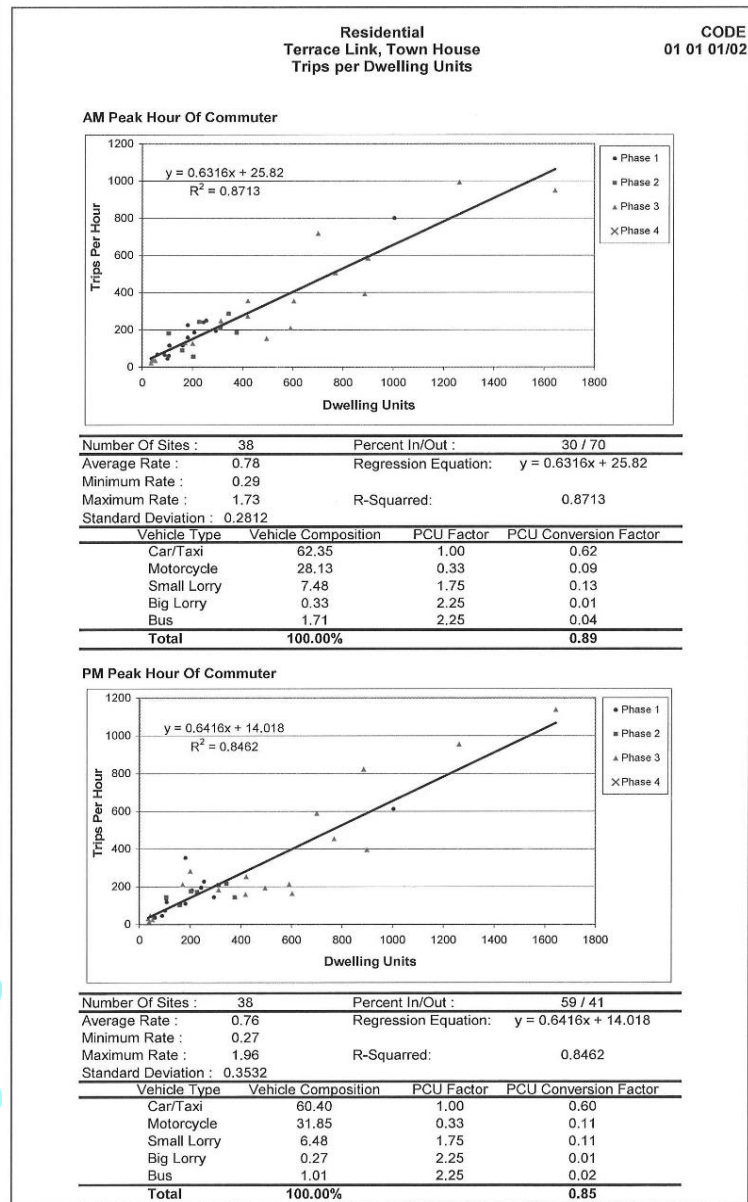


Figure 1-2(a): Example of Summary Sheet (Peak Hour of Commuter)

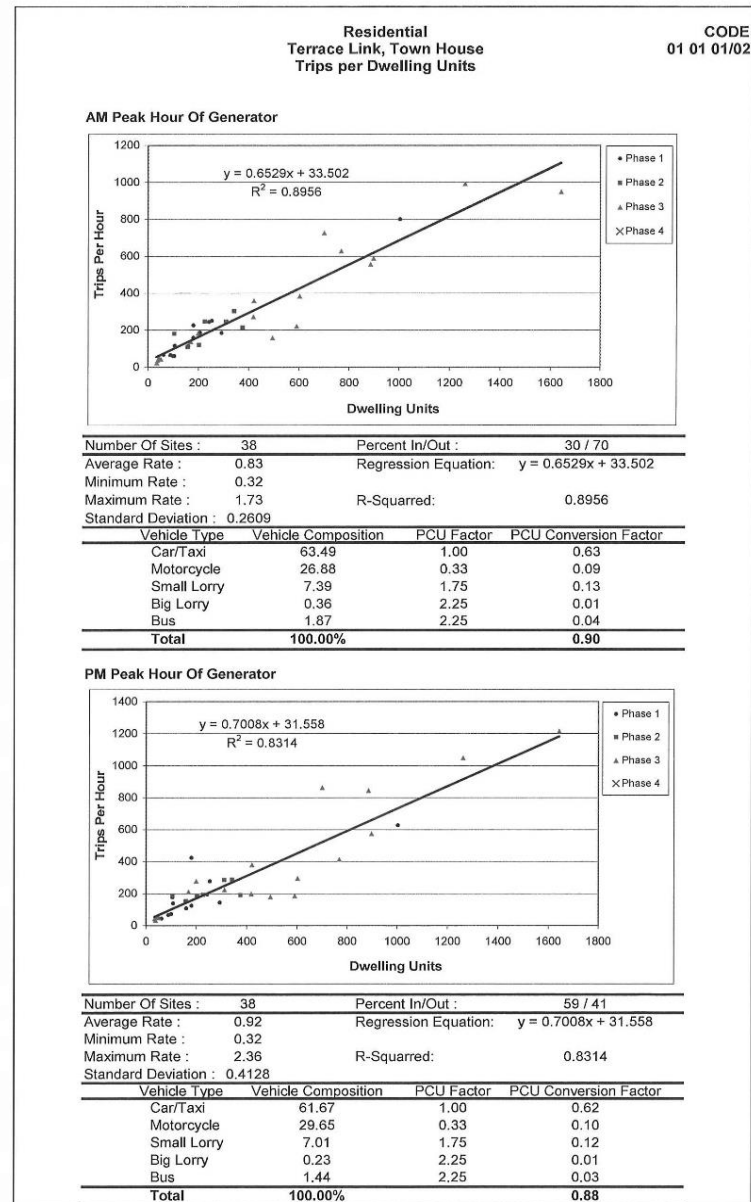


Figure 1-2(b): Example of Summary Sheet (Peak Hour of Generator)

MTG EQUATION

MTG linear equation takes the form
(R-square > 0.5):

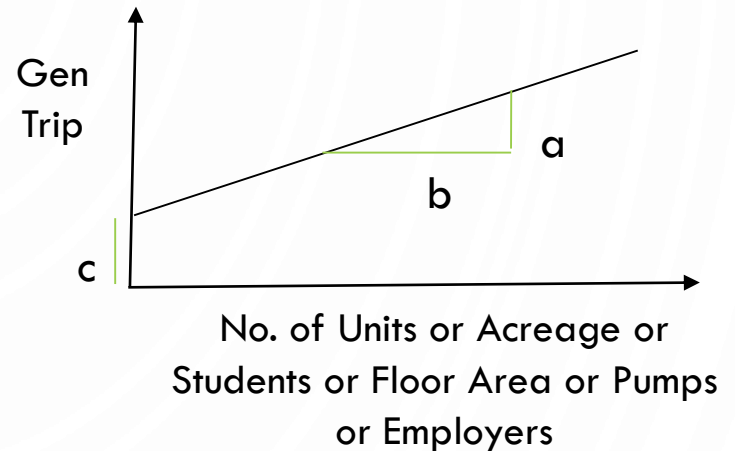
$$y = mx + c$$

Where y = trip gen

m = slope of the line

x = independent variable

c = the y-axis intercept



MTG average equation takes the
form (R-square < 0.5):

$$y = Rx$$

Where y = Trip gen

R = Average rate

x = independent variable

$$\text{Slope } m = a/b$$

$$\text{Y-intercept} = c$$

$$\text{For avg rate, } c = 0$$

STEP 4: CALCULATING VEHICLE TRIPS

- Once trip generation rates are selected, multiply trip rate with independent variable or plug-in values into trip gen equation
- Trips from the equations or rates are give in vehicles per hour
- Convert the estimated vehicle trips into pcu trips

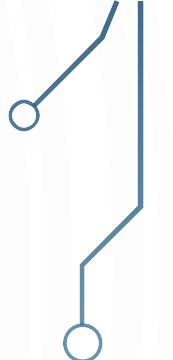
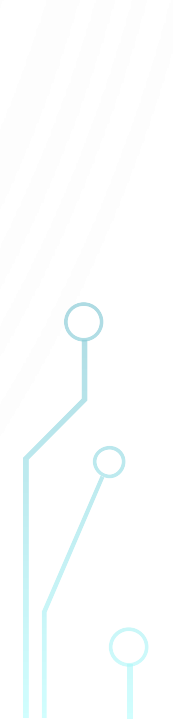
STEP 5: CONVERT INTO PCU TRIPS

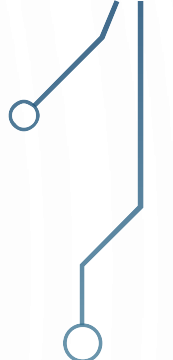
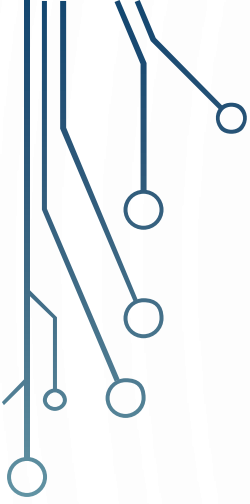
- Each graph has its own PCU conversion factor
 - Ie: Condominium

Vehicle Type	Vehicle Composition	PCU Factor	PCU Conversion Factor
Car/Taxi/Van	71.01	1.00	0.71
Motorcycle	21.99	0.33	0.07
Small Lorry	5.67	1.75	0.10
Big Lorry	0.02	2.25	0.00
Bus	1.31	2.25	0.03
Total	100%		0.91

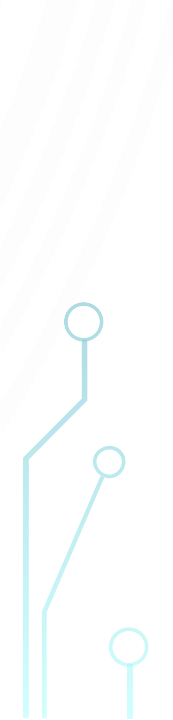


STEP 5: CONVERT INTO PCU TRIPS (CONT')

- Multiply the vehicle trips with PCU Conversion Factor to obtain trips in PCU.
- 
- 
- 



Permohonan Kebenaran Merancang Untuk Mendirikan:

- a) 1 Blok Pejabat 4 Tingkat
 - b) 1 Blok Bangunan 5 Tingkat yang Mengandungi Hotel 4 Tingkat (144 Bilik) dan 2 Tingkat Basmen Tempat Letak Kenderaan
 - c) 1 Blok Hotel 5 Tingkat (16 Bilik)
- 
- 

Cadangan Pembangunan	Paras	Kegunaan Ruang	Keluasan Lantai (mp)	Keluasan Lantai (kp)	Keluasan Lantai (1000kp)	Jumlah unit
Pejabat 4 Tingkat	Tingkat Bawah	Ruang Legar & Lobi Lif	103.00	1,108.68	1.11	
	Tingkat 1	Ruang Legar & Lobi Lif	103.00	1,108.68	1.11	
	Tingkat 2	Ruang Servis dan M&E	-	-	-	
	Tingkat 3	Pejabat	868.00	9,343.07	9.34	
	Jumlah		1,074.00	11,560.44	11.56	
Hotel 4 Tingkat (144 Bilik)	Tingkat 1	Podium Hotel & 21 Bilik Hotel	2,298.00	24,735.47	24.74	21
	Tingkat 2, 3 & 4	123 Bilik Hotel	6,412.00	69,018.19	69.02	123
	Tingkat Servis/ Bumbung	Bilik Lif Motor & Servis	-	-	-	
	Jumlah		10,339.00	111,288.07	111.29	144
Hotel 5 Tingkat (16 Bilik)	Paras 1	Kemudahan Hotel	272.00	2,927.78	2.93	
	Paras 2	Bilik Hotel (4 Bilik)	281.35	3,028.43	3.03	4
	Paras 3 - 5	Bilik Hotel (4 Bilik x 3 = 12 Bilik)	844.05	9,085.28	9.09	12
	Tingkat Servis/ Bumbung	Bilik Lif Motor & Servis	-	-	-	
	Jumlah		1,397.40	15,041.49	15.04	16

LAND USE AND THE CORRESPONDING TRIP GENERATION EQUATIONS

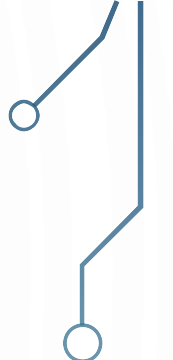
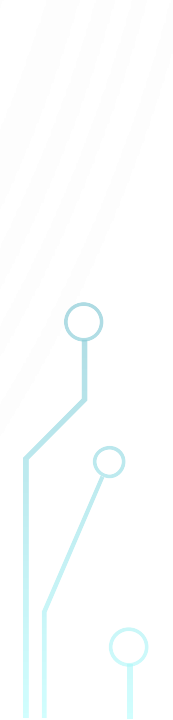
Sub-Categories	Code	Peak Hour	Equation/ rate	Variable	Pcu	In	Out
General Office	07 01 01	AM Peak Hour Of Commuter	$y = 1.54x$	Tsf	0.81	71	29
		PM Peak Hour Of Commuter	$y = 1.43x$		0.86	33	67
General, Beach Resort, Hill Resort Hotel	07 04 01/ 10/ 11	AM Peak Hour Of Commuter	$y = 0.45x$	Occupied Room	0.93	63	37
		PM Peak Hour Of Commuter	$y = 0.59x$		0.93	41	59

TOTAL GENERATED TRIPS BY THE DEVELOPMENT

No.	Type of development	Unit	AM peak hour				PM peak hour			
			Vehicle	Pcu	In	Out	Vehicle	Pcu	In	Out
1	4-Storey Office	11.56	18	14	10	4	17	15	5	10
2	4-Storey Hotel	144	65	60	38	22	85.0	79	32	47
3	5-Storey Hotel	16	7	7	4	2	9	9	4	5
	Total			81	52	28		103	41	62



STEP 6: INGRESS AND EGRESS TRIP (FOR TIA)

- Distribute the Generated trips (total trips) to ingress (In) and egress (Out) trips based on Percent In/Out
- 
- 
- 

A decorative graphic on the left side of the slide consisting of a network of thin, dark blue lines. These lines branch out and connect to small, open circles, resembling a stylized circuit board or a neural network diagram. The lines and circles are arranged in a way that suggests connectivity and flow.

Q & A

THANK YOU~