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Dear Sirs/Madams

REVISION TO TRAFFIC IMPACT ASSESSMENT GUIDELINE (TIA)

LTA has recently revised this guideline to update the information for the preparation and submission of Traffic Impact Assessment (TIA) reports as part of Development Clearance (DC) submission requirements.

This revision is the first since the introduction of the guideline in 2002. Several additions and new technical data that have been included in response to feedback received from the industry. The information would assist consultants preparing TIA reports and help to further expedite the submission process.

A summary of the major amendments and additions is provided on the last page of the guideline. The current development thresholds of when a TIA report is required to be submitted (Annexure A) remains unchanged. LTA earlier examined these requirements and decided that the current development thresholds reasonably reflect the intensity of those developments that generate sufficient traffic to impact their surrounding road network. Hence no tightening or relaxation of the thresholds is required at this stage.

Enclosed is a copy of the revised guidelines for your information and dissemination to your members.

Should you require further information, please contact the undersigned.

Yours faithfully

M. Mansour

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Senior Transport Planner
For Director of Planning, Local Planning
Enc.

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Guidelines for Preparation of Traffic Impact Assessment Reports

Revision (2007)

LTA has revised this guideline to update the information and requirements for the preparation and submission of Traffic Impact Assessment (TIA) reports. The guideline (i) specifies when a traffic impact study is required to be submitted as part of a development application (ii) sets out standards for the evaluation and preparation of traffic impact assessment reports.

The following is the first revision to the guideline that was introduced in 2002. It includes a number of amendments and additions made in response to feedback from the industry. A summary of the major amendments and additions is provided on the last page of the guideline.

Purpose of a TIA

The purpose of a TIA is to identify the transportation impacts of a new development on the surrounding transport network. The scale of such impact would depend on the type, size and location of the development and may vary from localised impacts such as at its access point(s) and nearby intersections for the smaller developments to regional impacts for larger developments.

The provision of adequate transportation network near a proposed development benefits those accessing the development as well as the community at large. Design oversights in regard to site access and circulation can lead to operational problems if left undetected. Traffic impact studies help in early identifications of such problems and can avoid expensive remedial actions if problems are left unaddressed until after development is completed. Additionally, a traffic impact assessment assists LTA to better plan and design the transportation system by enabling it to anticipate the incremental traffic impacts of each new development on the overall road network. The purpose of this document is therefore:

- To assist developers (and transport professionals who are so engaged) by outlining the requirements and the level of detail required for the study;
- To provide greater clarity, maintain uniformity and consistency in the preparation and evaluation of traffic impact studies so as to expedite the approval of development applications.

When is a Traffic Impact Study Needed?

A TIA is required to be submitted if the type and size of the proposed development meets one or more of the criteria stipulated in Annexure A. The size of the development reflects the level at which the development is likely to generate sufficient additional traffic that is likely to impact on the surrounding road network.

Because of differences in type, size and location of developments, it is not practical to describe a single scope of work that can be applicable to all proposals. The document is therefore intended to serve as a guide for consultants who are encouraged to discuss and review their scope of work with the LTA before proceeding with their studies.

Who Prepares a TIA?

The transportation impacts of the development shall be evaluated by a professional transportation firm appointed by the developer. The consultant should ensure (a) validity of all information and assumptions to be used in the study (b) discuss the project scope with LTA in advance of preparing the study.

Preliminary Discussion and Scoping Exercise

To assist in determining the extent of the TIA, developers or/and traffic consultants are encouraged to hold preliminary discussions with the LTA on their study scope and any specific requirements that may apply to the development prior to commencing the study. Such a discussion should ensure common understanding of relevant issues. Issues discussed may include but not be limited to:

- Study purpose and objectives,
- Proposed methodology and assumptions,
- Existing data intended to be reused,
- Size of the study area,
- Assessment year(s),
- Forecast background traffic volumes or growth rate to be adopted,
- Type of surveys to be undertaken e.g. link/intersection, travel time, origin-destination etc,
- Relevant peak hour(s) for the conduct of traffic surveys,
- Site(s) intended to be surveyed for the derivation of trip generation rates,
- Proposed modelling tool(s) and parameters to be used,
- Intended location of development's access point(s), parking provision and circulation,
- Other requirements if any, that may apply to the proposed development.

Requirements of TIA Reports

The following section outlines the information and assumptions that may be used to assist with the preparation of TIA reports. The information should be used in conjunction with Annexure B, which illustrates the structure and contents of a standard TIA report (Figure 1).

1. Executive Summary

1.1 The report should include a technical summary that concisely sums up the study purpose, major findings, conclusions and clear recommendations.

1.2 Improvements recommended in TIA are to be illustrated using concept plan(s) and incorporate sufficient details to substantiate their feasibility.

2. Study Purpose and Objectives

The objectives of the study, methodology, study timing and outputs shall be clearly stated. With large developments, LTA may require the submission of an inception report. The inception report may include but not be limited to the followings:

- Study objectives and scope of work,
- A description of the proposed development, size, location of access points, parking provision and intended circulation,
- Study area, roads and intersections to be studied,
- Existing landuse/transport network nearby,
- Assessment years, forecast growth rates,
- Study methodology and assumptions to be adopted,
- References/data from overseas intended to be used in the study.

The consultant is required to obtain LTA's endorsement of the inception report prior to commencing the study.

3. Description of Site and Study Area

3.1 Description of the proposed development including quantum, use and timeframe.

3.2 The size of the study area will depend on the type, size and traffic condition in the vicinity of the development. Generally, small developments that do not generate high volume of traffic are likely to have localised impacts so the area to be studied may include own access point(s) and the nearby major intersections. In contrast, larger developments with higher volume of additional traffic may impact the road network for a considerable distance from the site so a wider study area that may include already critical intersections would be needed. As a guide, the study area may be based on the extent of the impact of the development's traffic using preliminary estimation of traffic generation and assignment of development's traffic onto the road network up to major road/expressway or a point where development's traffic contribution becomes less than 100pcu[1] either to or from the site in the peak hour or alternatively experiences 10% or more increase in traffic on any approach leg to a junction due to the development's traffic. This is provided as a guide and consultants are advised to confirm the extent of the study area with LTA prior to commencing the study.

3.3 Analysis of contextual site issues e.g. size, current use, access points etc.

3.4 Description of the road geometry, pedestrian routes and bus stops near the development.

[1] Passenger car unit (pcu) equalises the impact of different vehicle sizes on traffic flow by converting vehicle classes to a common passenger car.

3.5 Appreciation of surrounding landuse and environs.

A map showing the location of the proposed development in relation to its surrounding road network and the overall study area is to be included.

4. Existing Traffic Conditions in the Area of Development

4.1 An assessment of all roads and junctions likely to be affected by traffic from the development during the peak hours is to be undertaken. The junctions and peak hours to be assessed should be determined in consultation with LTA prior to the commencement of the study.

4.2 In circumstances where the development's peak traffic generation occurs outside of regular peak hours then periods to be surveyed should include both the adjacent road network peaks as well as the development's peak period(s) which may occur in the off-peak or on weekend. This is to ensure that the access points are able to accommodate the peak traffic generated by the development during its busiest period(s).

4.3 For developments such as commercial, industrial and residential generally, morning and evening weekday peak periods are surveyed. Retail developments may require surveys on weekend as well as weekday. Traffic surveys are commonly carried out in 15 minutes intervals to determine the profile of traffic changes within the peak hour. Traffic surveys should be undertaken on a typical weekday or weekend (where applicable) and not affected by public or school holiday period. The result of the surveys should be summarised with the peak hours identified and graphically illustrated within the main body of the report.

5. Assessment Years

The assessment year is generally the year when the development is expected to be fully operational. For developments that are expected to be opened in phases, a separate assessment representing the expected completion date of each major phase would be required. LTA can advise on which assessment years to adopt.

Table 1 Assessment Years for New Developments

Size of Development	Assessment Year
Single phase developments	- Anticipated opening year assuming fully occupied - Five years after the full opening date
Multiple-phase developments	- Anticipated opening year of the first phase of the development - Anticipated year of completed development for all subsequent phases

6. Traffic Forecasts

6.1 For forecasts up to five years from current year, the background traffic volume is to be estimated using the growth factor method. Typical growth factors of 2% for the CBD and 3% per annum for non-CBD may be considered appropriate. Notwithstanding this, the location and proximity

of the development to other major new developments or new roads is likely to influence the extent of background traffic and other growth rates may be more applicable in some circumstances.

6.2 For longer future years forecast, LTA will advise on appropriate growth rate(s) to be adopted for the estimation of background traffic from its strategic transport model.

7. Trip Generation

7.1 Trip generation rates are to be based on survey(s) of similar development(s) agreeable to LTA. Information on the site(s) surveyed is to be included in a report appendix to substantiate similarities.

7.2 For developments where a comparable site may not exist, trip generation may be estimated from first principles e.g. employer numbers, number of visitors etc. based on a methodology agreeable to LTA.

7.3 For mixed developments such as retail/office or retail/residential where there may be interaction between the various land uses, a portion of the trips will be generated from within the development. The total traffic generation of the development is likely to be lower than the sum of individual uses if the rates were derived from stand-alone developments. A reduction in development's trip generation rate may be warranted when estimating the additional traffic on external roads.

7.4 The choice of sites and the time of surveys for the conduct of trip generation survey rates should be discussed at the scoping meeting.

8. Trip Distribution

8.1 A statement of methodology used to distribute traffic is to be provided for LTA's review. For most developments, the distribution of development traffic may be based on survey of an existing nearby development that is similar to the proposed development. Where such development is unavailable, current travel patterns on nearby links and intersections may be used to distribute traffic to/from the development onto the road network. For larger size developments or those likely to attract traffic from further a field, traffic distribution may be based on the area of influence of the development e.g. retail centre catchment area or from an origin and destination study to assign development's traffic to the appropriate routes. Larger developments may warrant the use of a transport model to obtain the distribution of traffic.

8.2 Diagrams are to be provided showing the directional and turning distribution of the proposed development trips onto the road network.

8.3 For mixed developments, different trip distribution for different components of the development may need to be adopted to account for

different travel behaviour of users.

9. Modal Split

9.1 Developments located away from major public transport nodes are likely to have higher vehicular generation compared to those nearer to public transport facilities. The trip generation rates should therefore account for the differences in level of public transport accessibility to ensure similarity. Adjustments to the trip rates would be required where level of public transport accessibility is significantly different. Modal split of a similar development in a similarly located site with similar level of public transport service would provide useful information and should be used wherever possible.

9.2 The TIA should address alternative mode of travel and the provisions to cater for pedestrians (Item 14) and cyclists' needs.

10. Traffic Assignment Resulting From the Development

10.1 The assignment of traffic from the development should be based on shortest travel time/cost in the peak periods (where appropriate, LTA may request the inclusion of weekend peak period) and shortest travel distance/cost in the off-peak periods. For large developments, assignment of traffic may need to be implemented using a transport model to account for different travel conditions on the available routes.

10.2 On routes with ERP, the applicable rate is to be converted to generalised time and added to the travel time for that route. LTA will provide the appropriate values of time for private and public vehicles.

10.3 LTA may require the consultant to substantiate the routes chosen for the assignment using field travel time and/or origin-destination surveys.

10.4 A diagram showing the routes and the assigned volumes is to be included in the report.

11. Assessment of the Change in Roadway Operating Conditions Resulting from the Development Traffic

11.1 The performance of the affected junctions shall be assessed using a commercially available junction modelling program. LTA uses the latest SIDRA software. Use of other analysis software would be acceptable provided that the intended software can produce results comparable to SIDRA's. The performance standards pertaining to SIDRA are shown in Tables 2 and 3. The performance criteria use average delay (sec/veh) and the degree of saturation to determine the intersection level of service (LOS).

11.2 The additional traffic from the development should not significantly worsen i.e. result in a change in LOS of the affected junctions. Design

should aim to provide a LOS "D" and degree of saturation 0.90 or better in the peak periods for intersections affected by the development's traffic.

Table 2 Level of Service Definition Based on Control Delay

Level of Service	Delay per Vehicle in secs (signalised & roundabouts)	Delay per Vehicle in secs (Give Way/ Stop Signs)	Definition
A	D≤10	D≤10	Good operation
B	11 to 20	11 to 15	Acceptable delays & spare capacity
C	21 to 35	16 to 25	Satisfactory, but accident study required for unsignalised junctions
D	36 to 55	26 to 35	Operating near capacity
E	56 to 80	36 to 50	At capacity requires other type of traffic control
F	d>80	d>50	Poor

Source: Highway Capacity Manual 2000, Transport Research Board

Table 3 Signalised Intersection Performance Based on Degree of Saturation

Critical Approach	Performance
X≤ 0.85	Under capacity
0.85<X≤ 0.95	Near capacity
0.95<X≤1.00	At capacity
X>1.00	Over capacity

11.2 In some situations, a travel speed survey would be useful in ascertaining traffic conditions for the route under consideration if the road is affected by high link flows or congestion at downstream junctions. The travel speed should include the running times plus delays at the signalised intersections along the route. Table 4 shows LOS based on travel speeds for arterial roads and expressways.

Table 4 Level of Service Based on Link Travel Speed

LOS	Arterial Rd	Expressway
A	>37kmh	>75kmh
B	≥35	≥72
C	≥32	≥67
D	≥27	≥63
E	≥17	≥43
F	<17	<43

In locations where queues from several signalised junctions are likely to interact, the performance of the affected intersections is to be assessed as a system using suitable modelling software. Consultants should seek LTA's advice at the scoping exercise on which software to use.

11.3 LTA generally requires the submission of softcopies of all data files for verifications of results.

12. Evaluation of Junction Performances

12.1 The values listed below are provided as a guide for the evaluation of isolated signalised junctions. Subject to justifications, other values may be adopted if they are considered more relevant to the circumstances of the development.

(a) Cycle time: Existing cycle time in peak hours or 120 seconds for a new traffic signal on arterial road,

(b) Peak flow factor: 0.95, lower for developments with significant demand peaking e.g. cinemas, concerts, sporting events,

(c) Basic lane saturation flow: 2,500pcu/hr/lane for expressways, 2,000pcu/hr/lane for arterial roads. Lower values are to be used for residential streets and environment with high roadside friction e.g. CBD,

(d) Delay definition: Control delay i.e. overall delay with geometric delay,

(e) Queue definition: 95% back of queue. Model queue lengths are to be calibrated to approximate observed queues,

(f) Passenger Car Units (PCU) for moving traffic as shown in Table 5.

Table 5 Passenger Car Equivalent Unit Factors

Vehicle Type	Passenger Car Unit Equivalent (pcu/veh)
Passenger cars & vans	1.0
Single unit trucks: - LGV - HGV	 1.3 2.25 - 2.75
Buses - Small - Large - Articulated	 1.6 2.5 2.9
Motorcycles	0.7

LGV: Light good vehicles with laden weights up to 3 tonnes
HGV: Heavy goods vehicle with laden weights more than 3 tonnes or with 3 or more axles
HGV: Lower pcu value appropriate for arterial roads higher value for expressways
Bus: Small bus includes up to 30 seats. Large bus more than 30 seats

12.2 For unsignalised junctions:
Performance definition as per Table 2.

13. Pedestrians

For major pedestrian generators such as large retail centres, schools, etc. an assessment of pedestrian volumes generated by the new development is to be carried out in the TIA. The assessment should include:

(a) Major pedestrian desire lines between the development and its connectivity to the nearby public transport facilities,

(b) Assessment of nearby pedestrian facilities including capacity of footpaths, stairways, crossings and their adequacy to cater to forecast demand,

(c) Pedestrian safety e.g. adequacy of sight distances at crossing facilities, conflict at driveways, provision of slow points etc.

The TIA needs to identify major desire lines to/from the development to MRT or bus stops based on shortest and most convenient travel distance. A plan of the site showing the desired pedestrian walk lines should be provided in the report. The location of crossing facilities, footbridges etc. are to match pedestrian movement needs with minimal diversion from the most convenient line. Justifications would be required on why a proposed facility cannot be provided on the desired line.

The TIA should also address pedestrian safety in terms of visibility and sight distances at intersections, entry/exit points to the development and road crossings.

Where the development is expected to generate very high volume of pedestrians, the TIA is to include an assessment of pedestrian numbers, capacity and performance of the facilities to substantiate the adequacy of the design to accommodate the expected pedestrian demand. Table 6 below shows the average flow LOS performance measures for pedestrian walkways. Evaluation of all pedestrian facilities should be based on performance standards and principles outlined in the US Highway Capacity Manual.

Pedestrian facilities should aim to achieve LOS "D" or better during the busiest periods to provide a reasonable level of comfort to pedestrians.

Table 6 Pedestrian Walkway Performance Measures

LOS	Density (m^2/ped) Ave. Flow (ped/min/m) Average Speed (m/s)	Description
A	>5.6 ≤16 >1.30	Free speed, no conflict with other pedestrians 
B	>3.7-5.6 >16-23 >1.27-1.30	Free walking speed, pedestrians become aware of others & respond to their presence 
C	>2.2-3.7 >23-33 >1.22-1.27	Walking speed still free, passing is possible in uni-direction, minor conflict in reverse or crossing movements 
D	>1.4-2.2 >33-49 >1.14-1.22	Restricted speed & passing, high probability of conflicts for reverse or crossing movements 
E	>0.75-1.4 >49-75 >0.75-1.14	Restricted speed & passing,, forward movement is possible only by shuffling, reverse & cross movements are possible only with extreme difficulties, limit of walking capacity 
F	≤0.75 Variable ≤0.75	Speed are severely restricted, contact with others, reverse & cross movements are virtually impossible, flow is sporadic & unstable 

Source: Highway Capacity Manual 2000, TRB

14. Parking and Access Provision

14.1 The number of parking spaces and access arrangement of new

developments shall comply with the requirements stipulated in "Handbook on Vehicle Parking Provision in Development Proposals" and "Street Works Proposals Relating to Development Works" Chapters 5, 6 and 7 stipulate in detail requirements for access points. Where relevant, requirements stipulated in other chapters are also to be complied with.

14.2 If any proposal is unable to meet the access provision and arrangement requirements or LTA considers that the development access point warrants detailed evaluation, the applicant shall demonstrate the viability of the proposed arrangement.

15. Recommendations for Site Access and Transportation Improvements

Provision of good site access and circulation for all users whether by car, public transport or walking helps toward the success of a development. The ease with which users move to/from the development to the nearby developments, roads and public transport facilities are important to the long-term success of the development.

15.1 The proposals (access, lay-by, drop-off point, pedestrian facility etc) should take into consideration the following requirements:

15.1.1 Safety – The location and configuration of the access, lay-by, drop-off point, pedestrian facilities etc should not pose danger to motorists and pedestrians.

15.1.2 Capacity of road – This shall be considered when designing the configuration of the access. For example, a Left-in-Left-Out (LILO) arrangement for joining access to a road with heavy traffic volume may be more appropriate.

15.1.3 Queuing Length – Sufficient queuing length should be provided at the proposed access, lay-by or drop-off point to prevent queue encroaching into the main carriageway and obstructing other traffic. The TIA shall include an assessment of entry barrier capacity and queue length to show that the distance between the frontage road and the car-park barrier is sufficient to accommodate the expected queue length.

15.1.4 Conflict of traffic – Proposal shall not create conflicts of traffic. Access points should not be located opposite each other, near bus stops or across very busy footpaths.

15.1.5 Obstruction to traffic – Manoeuvring of vehicles into the access is not to obstruct the traffic along the carriageway. All vehicles should enter and exit the site in a forward direction with no reversing allowed onto a public road.

15.2 Pedestrian/commuter facilities – Impact of the facility on the traffic flow

is to be analysed if a pedestrian crossing facility is proposed across a road. Depending on pedestrian/traffic volumes, other facilities such as an overhead bridge or underpass may be considered more appropriate.

15.3 Generally, proposals for signalisation of junction of development's access point on major arterial class roads will not be favoured unless special circumstances exist. If a new signal is proposed, the impact of the traffic signal on major road traffic flow is to be evaluated as described in Sections 11 and 12 of this Guideline to demonstrate that the proposed traffic signal will not significantly affect traffic flow or reduce speeds along the major road.

15.4 Access, roadway and junction improvements shall be in accordance with appropriate LTA design standards and specifications.

General Comments

- Report shall be set out logically with clear conclusions and recommendations.
- All assumptions and sources of information shall be clearly documented.
- Data is to be presented in tables and graphs rather than narrative text where appropriate. Intersection volume surveys for the peak hour(s) are to be illustrated graphically. Results of all traffic modelling should be summarised in table form and included in the main body of the report without having to refer to appendices.
- Figures and tables in the report shall be drawn in printed format and presented legibly.
- Ambiguities and validity/lack of information should be resolved with LTA as soon as possible. Inadequate reports would be returned to the consultant for completion or modification as needed.

Construction Traffic Management

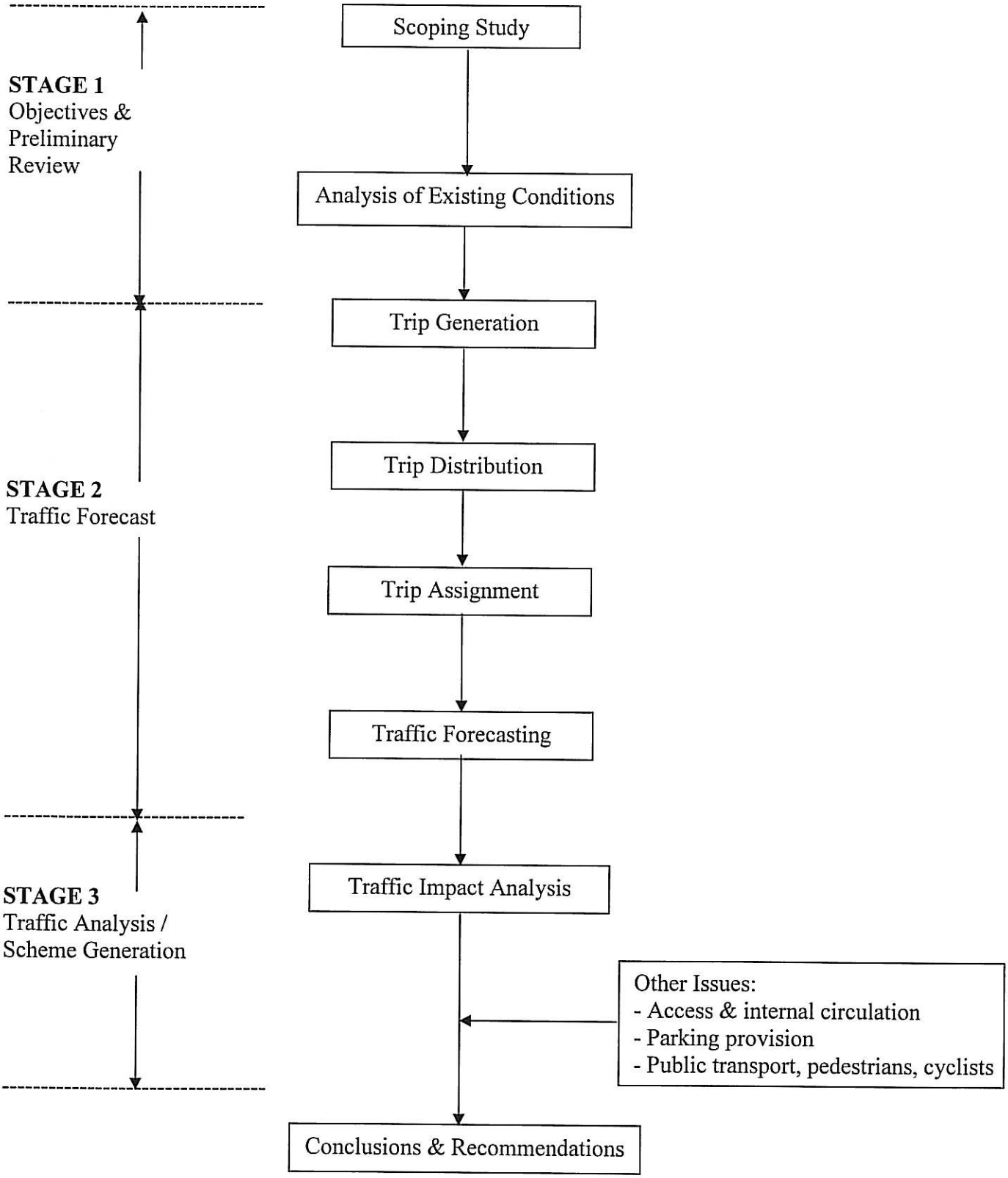
For very large developments, an assessment of the impact of traffic during the construction period may be required as a separate assessment/ submission (not part of the TIA study). LTA will advise whether such a study/evaluation is required to be submitted.

Summary of Major Amendments to the Guideline

Section	Amendments
Revision (2007)	Reasons for the revision
Purpose of a TIA/When a TIA is Needed?	New sections added
Preliminary Discussion and Scoping Exercise	New section added
Who Prepares a TIA?	Requirement for preparation of a TIA
Requirements of TIA Reports	Figure 1, flow chart for preparation of a TIA added
1. Executive Summary	Improvements recommended to be illustrated using a concept plan(s)
2. Study Purpose and Objectives	Details on inception report added
3. Description of Site and Study Area	Addition information on identifying extent of study area
4. Existing Conditions in the Area of Development	Various changes, paragraph 4.3 added

5. Assessment Years	- Size of developments in Table 1 simplified to "single" phase & "multi-phase". - Multi-phase development evaluation reduced to opening & completed development
6. Traffic Forecast	Minor changes
7. Trip Generation	- Information on site(s) surveyed to be included - Information on mixed developments added
8. Trip Distribution	Methodology for distribution of traffic expanded
10. Traffic Assignment Resulting From the Development	- Requirement for roads with ERP added
11. Assessment of Traffic Impacts of the Development	- Use of other junction modelling tool(s) and output - Paragraph 11.2 & Table 4 LOS based on travel speed for arterial roads and expressways added
12. Evaluation of Junction Performances	- Number of specified input parameters reduced - Saturation flow for arterials & expressways provided - Table 5, Passenger car equivalent unit factors provided
13. Pedestrians	- Various changes to provide greater emphasis on pedestrian facilities at public transport nodes - Table 6 pedestrian performance measures added
14. Parking and Access Provision	References to Street Works Proposals and Vehicle Parking Provision handbook updated
15. Recommendations for Site Access and Transportation Improvements	Introductory paragraph added
Construction Traffic Management	An assessment of traffic impacts during construction may be required for very large developments
Annexure A	Minor changes to the footnote of table
Annexure B	Minor changes to descriptions of what to be included in Sections 4.4 and 4.7

Figure 1 Typical TIA Process (For Developments)



ANNEXURE A
Conditions When a Local Traffic Impact Assessment (TIA) Would be Required

A TIA is required to be prepared at the Development Control stage if one or more of the following conditions apply to the development:

1. Developments exceeding the scales specified in the following table:

Type of Development	Scale of Development
Residential a. Landed properties/Condominiums/ Executive HDB housings b. HDB housing	 a. 600 or more units b. 800 or more units
Retail Shopping centres	>= 10,000m² GFA
Commercial Office developments	>= 20,000 m² GFA
Industrial a. General industries b. Warehousing/Distribution c. Science park/High tech park	 a. >=50,000m² GFA b. >=40,000m² c. >=40,000m²
Educational a. Primary school b. Secondary school c. International school d. Junior college e. University, polytechnic, ITE campus	 a. >=2,000 students b. >=2,000 students c. >=2,000students d. >=2,000 students e. TIA required
Medical Hospitals	>= 200 parking spaces
Hotel Business & tourist	>= 600 rooms
Recreational Exhibition centre & major tourist attractions	>= 200 parking spaces

Note:
For mixed-use residential/retail developments, a TIA will be required if the total trip generation of the development exceeds 200pcu/hr either inbound or outbound. In such instances, LTA would be able to advise applicant whether a TIA is required.

2. For types of development not listed in table above that may significantly impact on their surroundings, LTA may require the submission of a TIA. In considering whether a TIA is required, LTA will take into consideration the type, location and circumstances of the development proposed.

3. Any development seeking direct access either via a dedicated driveway or a new service/access road onto a Category 2 (major arterial) or above type road.

ANNEXURE B

Key Issues to be addressed in a Traffic Impact Assessment Report

Major Heading	Description of What to Include
1.0 INTRODUCTION	Description of the development proposal, study methodology, timing and output
1.1 Background	
1.2 Scope of Report	
1.3 The key Issues and Objectives of the TIA	
2.0 GENERAL DATA COLLECTION / EXISTING CONDITIONS	2.1 Current landuse characteristic of the site & in the vicinity, site access
2.1 Site Location	2.2 Description of road network & hierarchy, no. of lanes, medians, on-street parking & location of bus stops etc.
2.2 Description of Road Network	
2.3 Existing Traffic Flow & Conditions	2.3 AM and PM and off-peak (required only if development's peak hour different from commuter peak) peak hour intersection and classification counts at critical intersections, maximum queue length at intersections on critical approaches. Assessment of the performance of the intersection including average delays, degree of saturation & queue length on all approaches and for the intersection without the development traffic
2.4 Parking Supply & Demand	2.4 Current on-street parking supply & utilisation
2.5 Public Transport	2.5 Rail & bus stop locations & distance, pedestrian access routes to bus stops
2.6 Pedestrian Network	2.6 Identify existing pedestrian facilities & potential conflict locations with vehicles
2.7 Proposed Developments in Vicinity	2.7 Approved proposed developments/redevelopment sites adjacent to the site
3.0 PROPOSED DEVELOPMENT	3.1 Nature & size of the development, projected number of residential units, GFA of each component of development, hours & days of operations, staging and timing of development
3.1 The Development	
3.2 Access	3.2 Development access locations, sight distance of access points & comparison with stopping and desirable minimum sight distances, projected queuing at entrances
3.3 Traffic Circulation & Local System	3.3 The new road network, improvements to existing roads, circulation pattern & internal road layout
3.4 Parking	3.4 Proposed parking provision, parking layout, location of carpark entry/exit barriers, projected peak demand based on

3.5 Loading & Unloading Facilities	survey(s) of similar sites 3.5 Provision and operation of service vehicle area
4.0 IMPACT OF PROPOSED DEVELOPMENT	4.1 Estimation of future traffic volumes following the full opening of development taking into account background traffic growth and adjacent approved developments
4.1 Future Background Traffic	
4.2 Traffic Generation	4.2 Estimated peak hour traffic generation based on surveys of similar sites (survey results are to be included for reference)
4.3 Traffic Distribution & Assignment	4.3 Assignment of trips to the road system based on origin/destination surveys of similar or other developments in the area or another method agreeable to LTA
4.4 Impact of Generated Traffic	4.4 Projected traffic flows at key intersections for assessment years. Assessment of the performance of the intersection including the average delays, degree of saturation, back of queue length on all approaches to key intersections. Assessment of impact on residential amenity
4.5 Impact on Traffic Safety	4.5 Assessment of road safety impact e.g. whether a slip road should be considered at the entrance to the development to enhance safety
4.6 Pedestrians & Other Users	4.6 Provision for pedestrian crossings/overhead bridge to the bus stop & MRT
4.7 Recommended Works	4.7 Provide suitable justifications to show need for improvement. Improvements may include site access and circulation, local improvements to road junction(s) and any other traffic management measures. These should be shown on plan(s)
5.0 SUMMARY & CONCLUSION	A technical summary that concisely sums up the study purpose, conclusions and recommendations