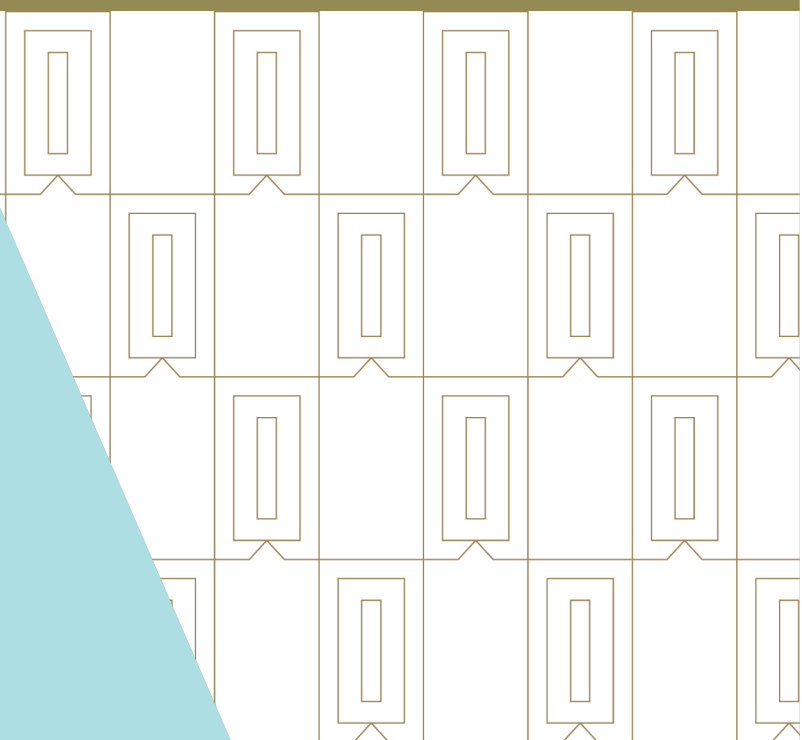


Ras Al Khaimah

RAK Traffic Calming Device Manual

Guidance for Planning & Design of Traffic Calming Devices

Volume 1:



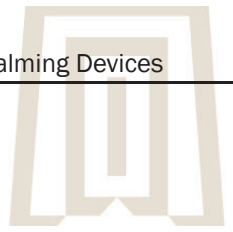
Ras Al Khaimah Municipality



بلدية رأس الخيمة

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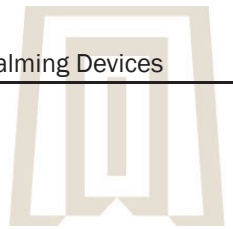


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List of Abbreviations and Definitions

Average Daily Traffic (ADT)	<ul style="list-style-type: none">The total traffic volume during a given time period, ranging from 2 to 364 consecutive days, divided by the number of days in that time of period, and expressed in vpd (vehicles per day).
85th Percentile Speed	<ul style="list-style-type: none">The speed at or below which 85 percent of the vehicles are travelling.
Cul-de-Sac	<ul style="list-style-type: none">A minor road which connects to the road network at only one end while the other end can only accommodate reversal of traffic movement and no through movements.
Curb	<ul style="list-style-type: none">A structure with a vertical, sloping, or horizontal face placed along the edge of a pavement, forming part of the gutter and strengthening or protecting the road edge and controlling access.
Design Speed	<ul style="list-style-type: none">A speed selected for the purpose of design and correlation of geometric features of a road.
Divided Road	<ul style="list-style-type: none">A road with a median separating two streams of traffic travelling in opposite directions.
Grade	<ul style="list-style-type: none">The profile of the center of the carriageway, or its rate of ascent or descent.
Lane	<ul style="list-style-type: none">A portion of the travelled way providing for a stream of traffic travelling in single file in one direction.
Posted Speed	<ul style="list-style-type: none">The speed limit displayed by means of road signs.
RAKTCDM	<ul style="list-style-type: none">Ras Al Khaimah Traffic Calming Devices Manual
Raised Crosswalk	<ul style="list-style-type: none">A traffic calming device comprising of a marked pedestrian crosswalk constructed at a higher elevation than the adjacent roadway. Its elevation is of the same level as the sidewalk and it is typically installed on curbed roads.
Raised Intersection	<ul style="list-style-type: none">An intersection – including crosswalks – constructed at a higher elevation than the adjacent roadways.
Road Marking	<ul style="list-style-type: none">A traffic control device consisting of lines, patterns, words, symbols, or colors on the pavement, either flush with the surface or slightly.



List of Abbreviations and Definitions

Roundabout	<ul style="list-style-type: none">• An intersection where all movements take place on a one-way circulating road around a central island.
Rumble Strip	<ul style="list-style-type: none">• Raised buttons, bars, or strips that are closely spaced at regular intervals on the roadway which creates noise and vibration in a moving vehicle.
Sight Distance	<ul style="list-style-type: none">• The length of roadway ahead that is visible to the driver without any obstructions.
Speed Cushion	<ul style="list-style-type: none">• A traffic calming device, typically in the form of a flat-topped road hump that only partially extends across a traveled way.
Speed Hump	<ul style="list-style-type: none">• A traffic calming device, built according to a standard profile (given in the DTCDM) which may be used to safely reduce vehicle speeds.
Speed Table	<ul style="list-style-type: none">• A traffic calming device comprising of a speed hump and lane markings for pedestrian crossing that is typically installed in uncurbed roads.
Traffic Calming	<ul style="list-style-type: none">• Techniques applied to local roads in order to slow vehicle speeds, deter through traffic, improve safety, and enhance the environment
Traffic Volume	<ul style="list-style-type: none">• The number of vehicles passing a given point in a certain period of time, normally quoted in vehicles (or Passenger Car Equivalent units) per hour (per lane).
Zebra Crossing	<ul style="list-style-type: none">• A pedestrian crossing marked by short wide pavement stripes parallel to direction of vehicular traffic and indicated by relevant signs.

1. Introduction

As Ras Al Khaimah (RAK) continues to develop and grow, the importance of effective speed management in urban and rural road networks is also increasing. Providing safe efficient mobility networks and liveable communities are priorities for the RAK Government, and the use of traffic calming devices (TCDs) can sometimes be part of achieving these objectives.

TCDs are among the engineering tools used by cities globally to achieve a measure of control over traffic speeds, when used together with enforcement by police and education campaigns for the wider public and within communities.

This technical guidance document “Planning and Design of Traffic Calming Devices in Ras Al Khaimah” sets out the required steps for traffic and road design practitioners to follow for traffic calming studies in RAK.

To ensure outcomes are consistent with the needs of the emirate, this standard incorporates the study of specific local requirements & data collection with research on local and international best practices and standards on traffic calming & traffic control devices.

All traffic calming-related requests must be directed to the Municipality Department for review.

2. Internal and External Stakeholder Contributors

2.1 Internal Stakeholders Contributors

RAK Municipality departments:

- Transportation and Traffic Department
- Town Planning Department
- Strategic Planning Department
- Infrastructure Department

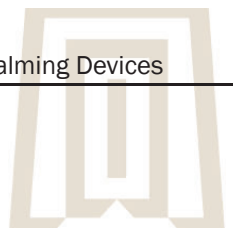
2.2 External Stakeholders Contributors

- Public Service Department
- Ras Al Khaimah Police General Headquarter

3. The Intended Audience

The concerned audience for RAKTCDM guidance interested in the recommendations produced from this guidance could be stated as follows:

- **Traffic Engineers**, who need to know the methodology, usage and the guidance required for traffic calming.
- **Planning Engineers**, who need to know the traffic calming measures recommendations related to the land use and master planning.
- **Road Designer**, who will use the traffic calming measure recommendations resulting from the analysis in updating the road geometry and junctions.
- **Infrastructure Designer**, who will use the traffic calming measure recommendations into considerations in planning and design of infrastructure.



4. Local Requirements and Context

Whilst there are numerous types of TCDs available to engineering practitioners, the historical context in RAK has witnessed focus on speed humps and speed tables throughout the emirate.

Notwithstanding the benefits of localized speed reductions and safety improvements that these TCDs may provide, there have also been unintended negative consequences of having a large number of speed humps and speed tables in the emirate. These include:

- Adverse impacts on response / service times for emergency response vehicles;
- Disruptions to water drainage;
- Incorrect installation and / or inappropriate placement of traffic calming devices along routes;
- Use of inconsistent dimensions, heights and materials for speed humps;
- Increased wear and tear on the general public vehicle fleet;
- Safety hazard for cyclists, e-scooter and motorcycle users.

Whilst there is potential for utilization of a broader range of TCDs in Ras Al Khaimah to help avoid some of the above issues, there are a number of constraints which have tended to limit their application as follows:

- Intermittent presence of raised curbing along many roads. Since many TCDs require the presence of raised curbs, the choice of other TCD options are reduced;
- Some roads have inconsistent hierarchical status (i.e., roads not functioning as per their planned hierarchy);
- The topography (mountainous nature) of Ras Al Khaimah limits the number of applicable TCDs due to high grades;
- A requirement for traffic calming solutions to be economical has tended to limit the selection of solutions.

To prevent these issues from propagating and/or worsening over time, there is a need for more stringent controls on the planning, implementation, and maintenance of TCDs in the emirate of Ras Al Khaimah. The following sections describe the recommended methodology.

5. Planning and Design Processes

Technical assessments for TCD candidate sites shall be subject to a two-step process comprising: a) Screening, followed by: b) Warranting.

All TCD candidate sites must first pass the screening requirements before proceeding to the warranting, and downstream planning and design. The planning and design methodology for TCDs is illustrated in **Appendix A**.

5.1 Preliminary Screening & Warranting

Preliminary screening and warranting requirements identify the minimum technical thresholds that need to be met by any given site before proceeding to detailed planning and design for TCDs in Ras Al Khaimah.

Table 1 summarizes the preliminary screening criteria and warranting thresholds for TCDs.

Table 1. Preliminary Screening and Warranting Criteria for TCD in Ras Al Khaimah

Road Characteristic	Requirements / Considerations	Remarks
	A) Preliminary Screening	
1. Longitudinal	The longitudinal grade of road sections must be less than or equal to 8%.	Traffic calming devices are not appropriate along steep grades.
2. Observed Operating Speeds	Observed 85th percentile speed of traffic along the section must be below the 'minimum threshold speed' (defined as 10 km/h above the posted speed limit).	This defines whether there is a speeding issue on site or not.
3. Segment Length	Length of road segment in question measured between two controlled intersections should exceed 100m.	The presence of an intersection control spaced within 100m will require traffic to slow down, and so TCDs are redundant in such circumstances.
B) Warranting		
1. Pavement Presence	The road is either paved or unpaved.	TCD options would be severely limited if the road is unpaved. The practitioner should consider the potential of future paving of the area before applying a TCD.
2. Road Classification	Road classification must be taken into account when choosing the appropriate TCD.	
3. Posted Speed (km/h)	Posted speed limits are one of the main considerations when choosing the appropriate TCD. ¹ This guidance generally considers two posted speed limits: 40 & 60 km/h.	Roads with higher posted speeds in general have higher hierarchy classification, which in turn limits the number of available options in accordance to point number 2.
4. Annual Daily Traffic	As with road classifications & posted speeds, the selection of TCDs should consider traffic volumes. This guidance considers 3 traffic volumes categories: ADT ≤ 1500, ADT between 1500 and 3000, and ADT ≥ 3000. It is appropriate to consider the range of suitable TCD measures for residential roads with volumes exceeding 3,000 vpd.	The potential for buses and emergency response vehicles to use these roads suggests the need to provide speed management while not adversely impacting road capacity or operations.
5. Curbing Presence	Whether or not curbing is available along the road is considered in the choice of TCDs.	Some TCDs depend on having curbs in place, while others do not
6. Sight Distance (m)	Whether the sight distance is greater than or less than 90m is considered in the choice of TCDs.	
7. Lane Width (m)	The choice of TCDs should take into account the lane width.	Curb extensions, lane narrowing, and serpentine solutions are not suitable for lanes less than or equal to 3.0m.

¹ Subject to the introduction of regulations of unposted speed limits in Ras Al Khaimah, residential local roads are generally designed according to a posted speed of 40 kph, collectors 60 kph, and arterials 60 kph and above.

A worksheet has been included with this guidance to aid in the selection process of warranted TCDs. Details about the “Traffic Calming Analysis Worksheet (TCAW)” are found in **Appendix B**.

5.2 Preferred Traffic Calming Devices for Ras Al Khaimah

The traffic engineering practitioners can assess and recommend traffic calming solutions based on their judgement and the conditions of a given site. Notwithstanding, the prevailing conditions in Ras Al Khaimah indicate some devices have either higher or lower applicability for use.

Key factors to be considered include: potential for speed reduction and impact on safety, cost, and presence of curbing. Table 2 summarises the preferences in the Ras Al Khaimah context, and Table 3 summarises the TCDs.²

Table 2. Preferences in Selection of Traffic Calming Devices Ras Al Khaimah

Factor	TCD Preference
Speed Reduction/ Safety Improvement	Measures with high speed reduction efficacy and high safety improvement potential are preferred.
Installation Cost	Measures with lower installation cost.
Curbing Required	Preference is given to TCDs which do not rely on the presence of curbs, which are not present along many local roads.

²This is for guidance only, and the engineer is required to assess each site based on its own merits and applicable budgetary constraints.

Table 3. TCDs- Categories and Evaluations Based on Preference Factors

Traffic Calming Devices	Category	Speed Reduction / Safety Improvement	Relative Installation Cost	Curbing Required
Primary				
Speed Humps	Vertical Deflection	High	Low	No
Speed Table	Vertical Deflection	Medium	Medium	No
Raised Crosswalks	Vertical Deflection	High	Medium	Yes
Raised Intersection	Vertical Deflection	Low	High	Yes
Textured Pavement	Vertical Deflection	Medium	High	No
Textured Crosswalk	Vertical Deflection	Low	Medium	No
Speed Cushions	Speed Cushions	Medium	Low	No
Mid-Block Median	Horizontal Deflection	Medium	Medium	Yes
Gateway Treatment	Horizontal Deflection	Low	High	Yes
Curb Extension	Horizontal Deflection	Medium	Medium/High	Yes
Curb (Corner) Radius Reduction	Horizontal Deflection	Medium	Medium	Yes
Lane Narrowing	Horizontal Deflection	Medium	High	No
Intersection Neckdown /Bulb-outs	Horizontal Deflection	Medium	Medium/ High	Yes
Traffic Calming Circles	Horizontal Deflection	High	High	Yes
Serpentine	Horizontal Deflection	High	High	No

Table 3. TCDs- Categories and Evaluations Based on Preference Factors

Traffic Calming Devices	Category	Speed Reduction / Safety Improvement	Relative Installation Cost	Curbing Required
Secondary				
Dragons Teeth Line Markings	Signing / Pavement Markings	Medium	Low	No
Red Carpet Paint Markings	Signing / Pavement Markings	Medium	Low	No
On-Street Parking	Horizontal Deflection	Medium	Medium/High	No
Neighborhood Education/ Public Info	Educational	Low	Low	No
Neighborhood Traffic Calming Sign	Signing / Pavement Markings	Low	Low	No
Higher Visibility Crosswalks	Signing/Pavement Markings	Low	Low	No
Traditional Enforcement	Enforcement	High	Medium	No
Turn/ Entry Prohibition Signs	Signing/Pavement Markings	Low	Low	No
Commercial Vehicle Restrictions	Signing/Pavement Markings	Low	Low	No
Rumble Strips	Signing/Pavement Markings	Low	Medium	No
Roadway Landscaping		Low	High	Yes
Roundabouts	Horizontal Deflection	Medium	High	Yes
Intersection Channelization	Horizontal Deflection	Low	High	Yes
Raised Median Through Intersection	Obstruction	Low	High	Yes
Turn/ Entry Prohibition	Obstruction	Low	Medium	No
Forced Turn Barriers/Diverters	Obstruction	High	Low	No
Traversable Barriers/Diverters	Obstruction	Medium	Medium	No
Cul-De-Sac & Street Closures	Obstruction	High	Medium	Yes

5.3 Development of Traffic Calming Alternatives

The design process is applying the warranted TCD in the context of site conditions, which must be taken into account when designing the warranted TCD to ensure each factor of the location is considered. The site survey covers the site conditions that affect the design of warranted TCDs and should include the following:

- 1 . Road geometry and road features;
 - 1.1 Measured locations / dimensions and photos of each road section and intersection, including carriageway condition (paved/unpaved) and pavement markings indicating position and direction.
 - 1.2 Measured locations / dimensions and photos of the site including all existing humps / TCDs, all traffic signs (including posted speed limit) / all poles / signals, driveways, and parking areas.
 - 1.3 Road carriageway / asphalt / median edges if absent in the masterplan, then to be recorded every 50m if straight and every 5m at curves.
 - 1.4 Indication of slope direction with slope arrows and roads levels at steep gradients.
 - 1.5 Measured locations for visible drainage /utility provision including manholes.
2. Measured locations / dimensions and photos of any structure or natural and / or landscape features (e.g. trees bushes) impacting sight distances of drivers.
3. Presence of sensitive land uses like schools, nurseries, mosques, hospitals, and malls.
4. Measured locations / dimensions and photos of pedestrian crossings (zebra crossings / raised crosswalks), cycle facilities, and traffic barriers / fences / bollards.
- 5 . Building and boundary walls;
 - 5.1 Indicate building use, building height, and number of storeys of concerned plots.
 - 5.2 Indicate building corner points and building entrance points of concerned plots.

After validating the applicability of the warranted TCD to the site in question, a detailed drawing showing the TCD developed according to the standardized typical drawings should be submitted to the Ras Al Khaimah Municipality taking into consideration the factors mentioned in Table 4.

Table 4. Design Considerations

Factor	Considerations
Pedestrian Generators	Locations of pedestrian generators (schools, parks, etc.) in the study area should have priority when choosing the location of the TCD. Areas where sidewalks are not present could be hazardous to pedestrians and safety considerations should be kept in mind at these locations.
Bicycle Facilities or Routes	Design considerations should be made if bicycle lanes or routes are present in the study area.
Adjacent Land Uses (Residential)	Residential land uses should be given priority during the design phase.
Road Geometry	<p>Road geometry affects the design of the TCD since geometric elements may support or not support the warranted TCD.</p> <ul style="list-style-type: none"> • Horizontal and vertical alignments can affect the placing and efficiency of the warranted TCD. • Sight distance and visibility should be considered as TCD should be visible to drivers especially at night. • Driveways and underground utility access to boxes and sewers should be avoided. • Adequate signage and markings shall be added to warn drivers of the TCD presence and guide their subsequent movement. • Drainage considerations should be made as some TCDs have drainage impacts. • Areas where transit vehicles manoeuvre to make a curbside stop should be avoided. Transit vehicles should traverse the TCD perpendicularly.
Existing TCDs	The design of the warranted TCD may differ based on existing TCDs in the study area. It is important not to over-supply TCDs in a given area.

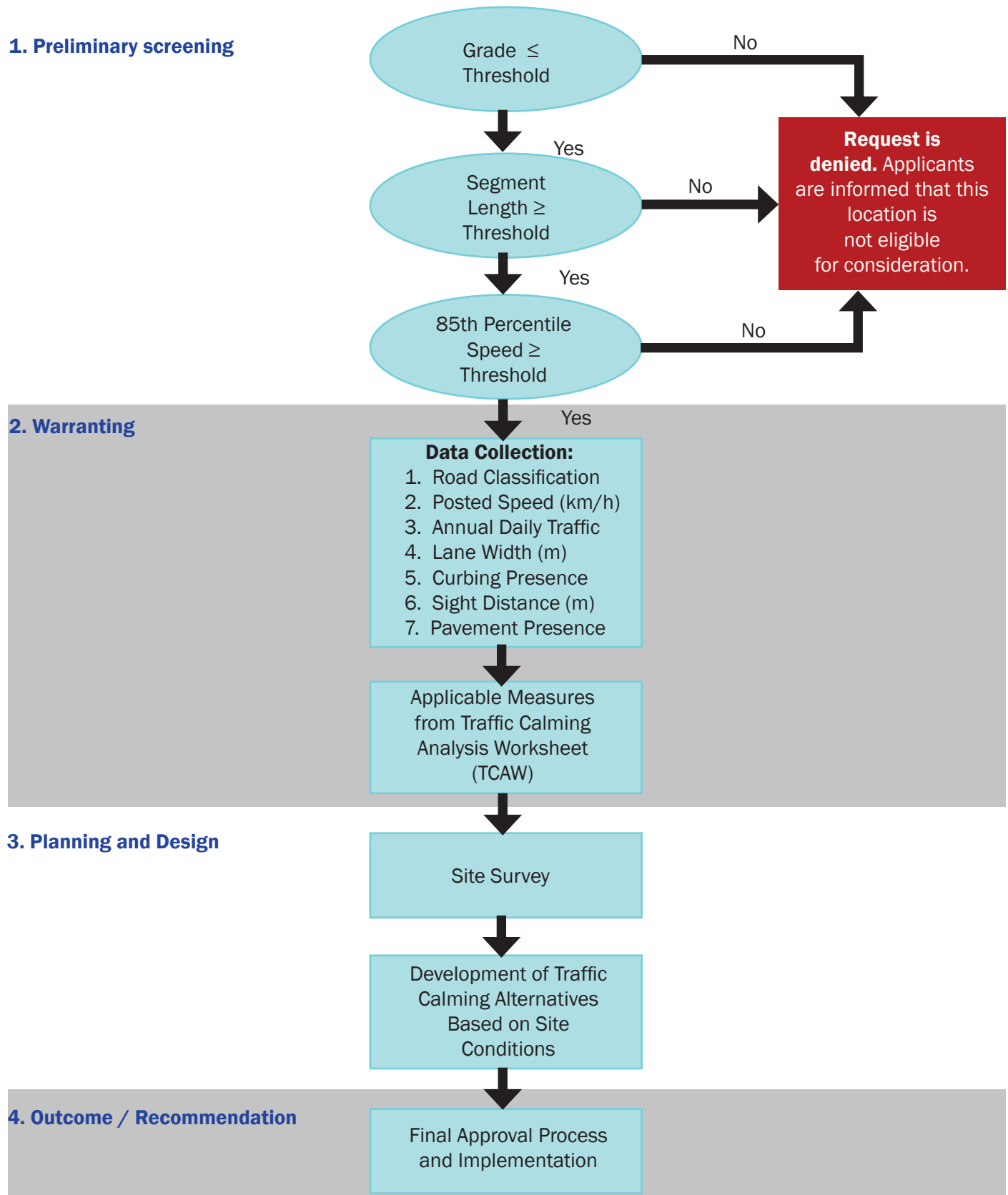


Appendix A

Methodology

The planning and design of TCDs is subject to the following general process as illustrated in the flowchart below:

Figure 1 : Flow Chart





Appendix B
Traffic Calming Analysis Worksheet
(TCAW)

The Traffic Calming Analysis Worksheet (TCAW) is designed to aid in determining if a site is eligible for traffic calming, and which traffic calming device(s) is warranted. The worksheet is divided into four sections as shown below:

- 1. General Information:** Includes description of the location, dates of request and analysis, and other relevant information.

Figure 2: General Information View



Ras Al Khaimah Municipality
Urban Planning and Engineering Sector
Traffic Calming Analysis Worksheet

Case Number:
File Location:
Location:
Date of Request:
Requested by:
Description of Complaint:

9494947
Location Folder
Sector 2 - Shams area
8/2/2021
Sultan Mohammed El Shohar
Request to install Traffic Calming Device

- 2. Preliminary Screening:** This is the initial criteria that will determine if the site is eligible for traffic calming.

- Grade:** enter the grade of the study area as a percentage (do not type '%'; it will be automatically added by Excel);
- Segment Length:** enter the distance, in metres, between stop-controlled points along the road;
- 85th Percentile Speed:** enter the 85th percentile speed in km/h then 10 km/h over the posted speed in the next tab.

Figure 3: Preliminary Screening View

Preliminary Screening			
Criteria	Value	Threshold	Pass/Fail
Grade		< 8%	
Segment Length	100	≥ 100 m	Pass
85 th Percentile Speed			

Proceed to Warranting Evaluation

- This is the criteria that will evaluate each traffic calming device and eliminate the traffic calming devices that are not warranted.

Figure 4: Warranting Evaluation View

Warranting Evaluation	
Criteria	Value
Pavement Presence	Paved
Road Classification	Local
Posted Speed (km/h)	40
Average Annual Daily Traffic (veh/day)	1,500 to 3,000
Lane Width (m)	3.5
Curbing Presence	No
Sight Distance (m)	≥ 90

- 4. Recommended TCD:** This shows which Traffic Calming Device is warranted for use at the location based on the warranting criteria. It lists the proposed TCDs and remarks for each. If the TCD is warranted for use at a given location, "Warranted" will be displayed next to the TCD. If the TCD is not warranted for use at the location, "X" will appear next to the TCD.

Figure 5 . Recommended TCD View

Recommended TCD		
Proposed TCD	Warranted	Remarks
Speed Humps	Warranted	High Speed Reduction, Safety Improvements and Pedestrian Safety, Low Installation Cost but Ongoing Maintenance Cost
Speed Table	Warranted	High Speed Reduction, Safety Improvements and Pedestrian Safety, low Installation Cost but Ongoing Maintenance Cost
Raised Crosswalks	X	High Speed Reduction, Increase Noise and Pollution and Loss of On-Street Parking, High Safety Improvements and Pedestrian Safety
Raised Intersection	X	High Cost High Safety Improvements and Pedestrian Safety, Less impact on Emergency Vehicles than Speed Humps/Tables
Textured Pavement	Warranted	Low Speed Reduction and Increase Noise and Pollution
Textured Crosswalk	Warranted	Low Speed Reduction and Increase Noise and Pollution
Speed Cushions	Warranted	Increase Noise and Pollution
Mid-Block Median	X	Loss of On-Street Parking and Low Speed Reduction, High Pedestrian Safety
Gateway Treatment	X	High Cost
Curb Extension	X	High Environmental Impact and High Cost, High Pedestrian Safety
Curb Radius Reduction	Warranted	High Speed Reduction, Medium Environmental Impact High Pedestrian Safety
Lane Narrowing	X	Low Speed Reduction, can be Costly if involves Entire Street Reconstruction
Intersection Neckdown/Bulb-Outs	X	High Speed Reduction, High Cost, High Pedestrian Safety
Traffic calming Circles	X	High Speed Reduction, Low Pedestrian Safety, can be Combined with Speed Humps on Approach to Improve Safety
Serpentine	X	High Speed Reduction, Low Pedestrian Safety and High
Dragons Teeth line Markings	X	Low Speed Reduction
Red Carpet Paint Marking	X	Low Speed Reduction
On-Street Parking	X	High Cost
Neighborhood Education/Public Info	X	High Impact in the Future not Now
Neighborhood Traffic calming Sign	X	Low Speed Reduction, Low installation Cost, Generally Used in Combination with Other Measures
Higher Visibility Crosswalks	X	Low Speed Reduction



Recommended TCD		
Proposed TCD	Warranted	Remarks
Traditional Enforcement	Warranted	High Speed Reduction, Medium Cost
Turn/Entry Prohibition Sign	Warranted	Low Speed Reduction
Commercial Vehicle restrictions	X	Only Affects Commercial Vehicles
Rumble Strips	X	Low Speed Reduction, Low Installation Cost
Road Landscaping	Warranted	High Cost
Roundabouts	Warranted	High Cost, High Safety Improvements, Low Pedestrian Safety
Intersection Channelization	Warranted	High Cost
Raised Median Through Intersection	Warranted	High Cost
Turn/Entry Prohibition	X	Medium Cost
Forced Turn Barriers/Overters	X	High Speed Reduction, High Cost
Traversable Barriers/Diverters	X	High Speed Reduction, High Cost
Cul-De-Sac & Street Closures	Warranted	High Cost, Improves Safety for Motorists, Pedestrians and Cyclist

When completing the worksheet, all information should be entered only in the yellow cells; the white cells are either headers or calculations results. When the user clicks on the yellow cells, a message with instructions about how to enter the information will be displayed. If the information is entered in an incorrect format, an error message will be displayed.