

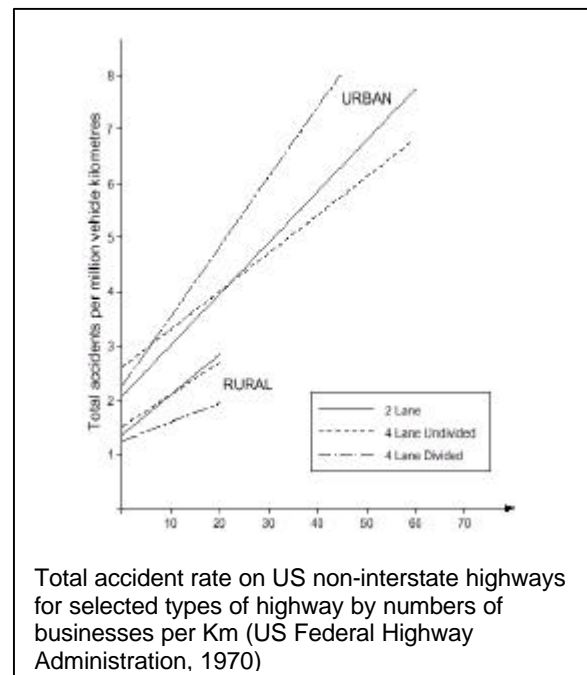
Roadside, Village and Ribbon Development



The Problem:

Any development allowed to grow alongside a rural highway, unless it has been planned and designed correctly, will generate traffic and pedestrian movements that can lead to accidents that could have been prevented. Vehicles turning into or out of premises cause particular problems, especially when the vehicles have to cross an opposing stream of traffic. Pedestrians crossing or walking along the road near such developments are also frequently involved in accidents. Research in developed countries shows that the accident rate on a rural highway doubles at about 15 businesses/km or 6 accesses/km and as a result tight restrictions on such developments have been in place for many years. Service roads with properly designed junction accesses are one of the standard solutions.

In many developing countries, lack of planning controls have allowed roadside development to become a major problem, from individual sellers of market produce scattered along a highway to the many kilometres of ribbon (linear) development that can be seen in a number of countries. Villages frequently move to a highway after it has been constructed or upgraded. Two basic problems are at the heart of this – access to buyers of produce and access to good transport.



The Solution:

- Educate, Encourage and Enforce individual sellers to use lay-bys in the vicinity or choose locations where vehicles can pull off the road.
- Where a small informal market has developed, planners and engineers should examine the possibility of constructing a lay-by. The market should be restricted from developing on both sides of the road.
- Where larger informal markets have developed, planners and engineers should examine the possibility of constructing a more formal Market and Rest Area, with angled parking, an area for stalls and toilets, and with short deceleration and acceleration lanes into and out of the site.
- Where major rural highways go through a village, the villagers should be encouraged to develop their village only on one side of the highway.
- Gateways at the entrance to a village or in advance of a market should be erected and any appropriate speed reduction devices introduced.
- Much stricter planning controls should be introduced to utilise slip roads and service roads to prevent ribbon development having direct access onto the highway.

Recommendations for Good Design

Selling Produce:

- Where nearby lay-bys exist, villagers should be encouraged to set up their stall in these areas rather than in areas where no off-road parking is available.
- Highway designers and planners should consider providing special lay-bys for each village along the highway to sell their produce.
- Where this is not possible, villagers should be encouraged to choose sites where vehicles can easily pull off the road.
- Edge lining and / or different textured or coloured road surfacings should be used to delineate safe parking areas away from the main carriageway.
- A low-cost shelter at the rear of a lay-by can encourage traders to set up their stall away from the road.



Informal Markets: In a number of countries, a location beside a highway which has perhaps just a few roadside sellers can over a number of years develop into a full-scale market. A major road junction is a typical site where such informal markets tend to appear. They can then become a de facto mini bus station. Since these markets develop in a haphazard manner, there is generally little concern about road safety. In extreme cases, vehicles travelling at 90km/h or more can be just a couple of meters from stalls.

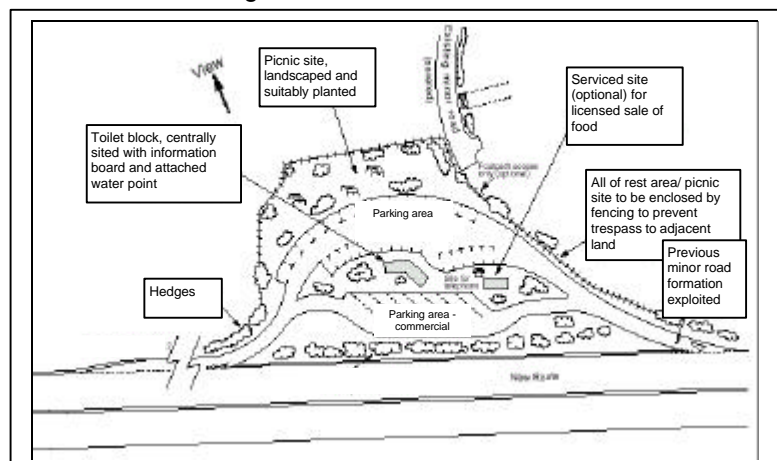


The same principles apply to informal markets as to small produce selling stations, however the local community should also encourage better planning of the market, by:

- Restricting the market traders to one-side of the road to minimise pedestrians crossing the main through carriageway.
- Clearly delineating the parking areas from the main road carriageway.
- Restricting overtaking prior and through the market area by the introduction of a solid central line or a physical barrier.
- Providing warning signs and possibly a 'gateway' and maintaining good visibility on the approaches to the market area.

Formal Market/Rest Areas: In some countries the markets grow to a point when they are permanent features of the community, attracting a large number of traders and other related industry, such as taxi services, bus routes, commercial trade, etc. Under these circumstances it is preferential to try to plan a safe space for the market to be held, which, may also provide sanitary services, formal parking areas and possibly even picnic sites for weary travellers. In selecting such sites a number of factors must be considered:

- The site requires the availability or construction of a potable water-supply, sewage disposal facilities and electrical supply.
- All the potential rest area sites to be investigated must have safe visibility for access and departure.
- The site should not be within 250m of the access or egress points of a junction and the design should provide for main carriageway traffic in accordance with appropriate standards.



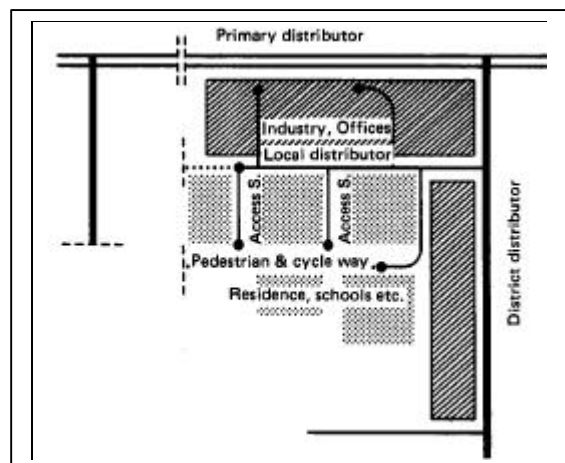
Ribbon development: In the UK it has been accepted for more than 50 years (when the 1936 Restriction of Ribbon Development Act was introduced) that if trunk roads are to perform satisfactorily as channels for longer distance traffic, the number of connections for vehicular access must be limited. Access traffic has three effects on long-distance transport, all local trips are undertaken on the main carriageway and therefore add to the traffic on the trunk road, vehicles exiting and entering the main carriageway slow other traffic, and the increased vehicle movements can give rise to accidents. This CaSE study has shown that connections for vehicular access are one of a number of features which are statistically significant in modeling the safety risk on the trunk road network. The impact of ribbon development on through traffic can be minimised by restricted or controlled planning of residential and commercial property along the route. Where this is not possible, the introduction of traffic calming techniques to improve driver behaviour and thereby protect the most vulnerable road users is desirable.



The Solution:

- Limit the number of direct accesses, T-junctions and cross-roads onto the main carriageway by visibly constructing a barrier (e.g. open drain or kerb) or by connecting a number of accesses to a service road that connects into the main highway.
- Use roundabouts to link other roads into the main highway as they provide safer traffic movements than for T-junctions or cross-roads.
- Encourage local development through the introduction of improved planning regulations and education to construct property backwards from the road rather than along the road.
- Encourage industry to locate similar businesses close together in order that freight traffic is largely restricted from residential areas and shopping districts.
- Design accesses to provide a safe gateway to the main carriageway through the provision of adequate visibility in both directions, adequate entry and exit turning radii and forward warning of a junction for drivers using road signs and markings.

The Road Hierarchy: The general safety engineering principle is that wherever possible, access to and from a property should be to a local or access road, not a primary or district distributor.



Linear Villages

Throughout the developed and developing world, residents are concerned about the speed and/or volume of traffic through their villages to the point where in a number of countries they have put in their own road humps or dug trenches across the road. The rural roads used in the CaSE study confirm this perception of danger as their accident rates are, on average, 60% higher on roads in areas bordered by property, either residential or commercial. This is reflected in the models produced: these confirm that the presence of urban development, or the increased pedestrian activity associated with it, will normally yield higher accident frequencies.

Traffic Calming





Properly engineered traffic calming schemes can help to create a safer environment for all road users. Research in the UK (Wheeler and Taylor, 2000) analysed the impact of 56 village traffic calming schemes and found that overall they resulted in a one third reduction in fatal and serious injuries, and a one fifth reduction in all injury accidents. Fatal and serious child pedestrian accidents were reduced by 75% and child cyclist accidents of all severities were reduced by 50%. The schemes ranged from minor gateway features to physical restrictions such as chicanes, narrowings, mini-roundabouts and road humps in the village and/or at the gateways.

Traffic calming measures take many forms and do not have to incur high cost to result in reduced numbers or severity of accidents. The schemes aim to change the driver's visual perception of the road environment as they enter the village so that they adjust their driving style to better navigate any obstacles / events encountered. The aim of the scheme should be to adequately warn the approaching driver in advance of the change in environment.

Typical Traffic Calming Measures



Approach Zone:

The approach zone is used to warn drivers that they are about to enter a section of road that has a higher level of development than the previous section of road (i.e. village or market area) and they therefore need to adapt their driving behaviour to anticipate the increased pedestrian activity and traffic movement.

<p>Gateways</p> 	<p>Located to mark the entry usually from a rural area into an urban environment.</p> <p>Aims to reduce the speed of vehicles to a more appropriate level to cope with the potential dangers & hazards.</p> <p>Must be conspicuous to be effective.</p>	<p>Cost 🇮</p> <p>Safety ★ ★ ★</p>
<p>Road markings</p> 	<p>Located on any road where there is a need to convey information or warnings. When used in conjunction with a gateway they can further enforce the visual impact.</p> <p>There are many types of road markings: e.g. "STOP" at intersections, "SLOW" before a bend or other potentially hazardous location, and speed limit roundels.</p>	<p>Cost 🇮</p> <p>Safety ★</p>
<p>Rumble Strips & Rumble Areas</p> 	<p>Small raised areas of course aggregate with a vibratory audible and visual effect when driven over.</p> <p>Located on carriageway and/or across road shoulder. Alerts drivers if they enter a hazardous area e.g. entering a residential area/before a crossing. Because of noise pollution they should ideally be located more than 200 metres from residential properties. Aggregate can 'pick out' if not properly adhered to the road surface.</p>	<p>Cost 🇮 🇮</p> <p>Safety ★ ★</p>
<p>Jiggle Bars</p>  <p>Source:DTLR</p>	<p>Located across the carriageway.</p> <p>Found at entrance to villages, where there is a speed limit change or as a warning to potential dangers ahead.</p> <p>Alert drivers to the dangers of the road</p> <p>Can cause noise pollution for local residents (see above).</p>	<p>Cost 🇮</p> <p>Safety ★ ★ ★ ★</p>




Transition Zone:

The transition zone lies between the approach zone and core area. Changes in road geometry, enforcement and visual appearance are introduced prior to the core zone to help physically encourage a change in driver behaviour.

<p>Carriageway deviations</p> 	<p>Located where a major road enters the actual village area where as well as vehicle parking there is likely to be more pedestrian and non-motorised vehicle activity. Reduction of carriageway width forces drivers to deviate their path slightly leading to a self-enforcing reduction in approach speed as well as serving as an alerting device to the change of environment. Use of a refuge island at the deviation also helps pedestrians in crossing a busy road.</p>	<p>Cost 🇸🇰 🇸🇰 🇸🇰</p> <p>Safety ★ ★ ★ ★</p>
<p>Barrier Kerb footpaths</p> 	<p>Located where pedestrian activity is high and a kerbed footpath is not appropriate. The footpath barrier segregates vehicular traffic and pedestrians with a physical barrier. Drivers are deterred from straying into the footpath area and driver speeds are lowered due to the visual effect of the barrier reducing the road carriageway width. Type shown could cause severe injuries in motorcycle collisions.</p>	<p>Cost 🇸🇰 🇸🇰</p> <p>Safety ★ ★ ★</p>

Core Zone:

The core zone is the area that has increased pedestrian and non-motorised transport activity and more turning movements. The safety countermeasures in this region are used to either visually or physically enforce lower speeds and to remind drivers of the dangers arising, e.g. schools, junctions, etc.

<p>Round Top Humps</p>  <p>Source: DTLR</p>	<p>Humps provide a physical barrier to vehicles causing them to reduce their speed to navigate the feature safely. The height of the hump and approach angle determine the speed that the vehicle has to reduce to. Typically humps are 100mm or 75mm high and 3.7 metres long. Used in sequence the lower vehicle speed can be maintained over a longer section of road. They are appropriate for areas with a 30mph (50km/h) or less speed limit.</p>	<p>Cost 🇸🇰 🇸🇰</p> <p>Safety ★ ★ ★ ★ ★</p>
<p>Flat Topped hump</p> 	<p>Located where there is a need for pedestrians to cross and ensure low speeds. Aims to increase pedestrian conspicuity to drivers. Used in conjunction with round-top humps. Requires additional drainage as it should be constructed kerb to kerb to avoid tripping.</p>	<p>Cost 🇸🇰 🇸🇰 🇸🇰</p> <p>Safety ★ ★ ★ ★ ★</p>
<p>Warning Signs</p> 	<p>Used in advance of potentially hazardous features for which drivers may need to slow down. Located ideally where it will break the drivers line of sight. Low maintenance and do not require special illumination if retro-reflective. Can be stolen or vandalised.</p>	<p>Cost 🇸🇰</p> <p>Safety ★</p>

Case Study: Fiji

This scheme formed one of the first Village Traffic Calming Schemes developed in Fiji by the Traffic Accident Road Safety Unit (TARSU) in the Department of Works. In 2000, a Guideline for implementing traffic calming in villages was issued: 'Guideline for speed reduction measures in villages – The Village Treatment' which specifies a framework for typical village treatments.



1. In the approach zone, drivers are made aware that open road speeds must be reduced down to 50 km/h. The gateway emphasises the start point of this change. A road-marked bar pattern (17 bars) can be used in advance of the Gateway. In this example, the gateway design is based on a traditional Fijian club.



2. The transition zone is the section between the village gateway and the core zone. The carriageway width is reduced from 7.3m to 6.5m, but the shoulders increase from 1.5m to 1.9m. The speed limit is normally 50 km/h. Signing is placed in advance of the physical restrictions. Rumble bars can also be used to emphasise the change.

3. The core 40 km/h zone is normally the centre of the village where most conflicts between pedestrian and vehicles take place. Road humps have been used as the main means of producing a self-enforcing reduction in speed, in accordance with either round top hump or flat-top hump design. Advisory 20 km/signs are also added and bus-bays and shelters provided.



References

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CaSE Design:

The purpose of this project is to identify highway engineering designs that are inherently safe and that fulfil their engineering function at little or no extra cost to alternative designs. It is also concerned with the challenge of making low-cost engineering designs as safe as possible at minimum additional cost. If you have any suggestions for such designs or have comments on this CaSE Note, please contact Stephanie Kirk, Brian Hills or Chris Baguley at International Division, Transport Research Laboratory, Old Wokingham Road, Berkshire, UK RG45 6AU. Email Skirk@trl.co.uk, Bhills@trl.co.uk or Cbaguley@trl.co.uk

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Cost and Safety Efficient Design
for rural highways in Developing Countries

