097.13 DPWH
02.22.2013

Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
OFFICE OF THE SECRETARY
Manila

FEB 21 2013

DEPARTMENT ORDER)
) **SUBJECT: CLARIFICATION ON THE DEFINITION AND DIFFERENCE BETWEEN WIDENING AND PAVING OF SHOULDERS**
NO. 22)
Series of 2013)

It has been observed that road widening projects are being confused with paving of shoulders. Hence, for clarification and common understanding on the difference between road widening and paving of shoulders, the following definitions/clarifications are hereby prescribed:

Road widening is a network development project which aims to increase the capacity of the existing highway/road or to improve the safety aspects of the road. Widening shall be primarily considered along road sections with Volume Capacity Ratio (VCR) of more than or equal to 0.60 as prescribed in the Department's Highway Planning Manual. The improvement of the road shall only be considered "road widening" if the increase in the carriageway width is equal or more than the minimum lane width of 3.05m, designed as part of carriageway width, with the same thickness as the existing carriageway width and should be provided with shoulder or sidewalk.

Paving of shoulders cannot be considered as widening because it will not increase the road width by at least 3.05 meters. Further, DO No. 40, series of 2012, prescribes a minimum shoulder width of 1.50 meters. Please be guided by this DO in shoulder paving along national roads.

For strict compliance.

ROGELIO L. SINGSON
Secretary

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WIN3Q20074

11 TRAFFIC CAPACITY STANDARDS

Potential new roads and bridges are usually identified using traffic assignment models with input from origin—destination surveys conducted at the roadside to arrive at spatial traffic volumes between zonal pairs. Based on the so-called desire lines between zones, traffic can be assigned between alternative routes according to assignment-choice criteria such as "all or nothing" or more sophisticated capacity constraint models; all using least travel time or vehicle operation costs as assignment criteria parameters.

Existing traffic service levels for all road sections are determined using traffic data from the Road Traffic Information Applications (RTIA) or the Road and Bridge Information Application (RBIA). Future service levels for each road section are identified using a transport model (e.g., assigning projected transport demand to the network) or using simpler methods of projection of traffic volumes by section at the regional level (e.g., using traffic growth rates at the regional level).

The RBIA is also the repository for data related to road geometric and operational characteristics such as pavement type, carriageway width (m), number of lanes, and roughness, measured in units of the International Roughness Index (IRI). These constitute the basic road information required for running the HDM-4 applications. This information, together with baseline traffic data and future traffic, is required to establish the existing and future traffic service level for each road section to pinpoint so-called hotspots of traffic congestion measured as the hourly design traffic volume over the road section's Basic Hourly Capacity in Car units (BHCC), called the Volume Capacity Ratio (VCR). The VCR calculation system is illustrated below.

One of the important parameters in the VCR is road capacity, which according to the Highway Capacity Manual, Highway Research Board, Washington D.C., 1965 (subsequent editions still use the essence of that generic definition), is defined as follows: capacity is the maximum number of vehicles, which have a reasonable expectation of passing over a given section of a lane or a roadway in one direction or in both directions during one hour under prevailing road and traffic conditions. The traffic volume at the upper E level is per definition equal to THE CAPACITY. The borderline between levels E and F is also referred to as VCR=1.00. The levels are defined as follows:

- Level A: free flowing traffic, VCR less than 0.20;
- Level B: relatively free flowing traffic, VCR between 0.21 and 0.50;
- Level C: moderate traffic, VCR between 0.51 and 0.70;
- Level D: moderate/heavy traffic, VCRbetween 0.71 and 0.85;
- Level E: Heavy traffic, VCR between 0.86 and 1.00; and
- Level F: Saturation traffic volumes, stop and go situations.

At level F, capacity will actually start to drop because of heavy congestion and low travel speeds.

The hourly capacity is influenced by the following factors:

- Number of lanes;
- Carriageway or lane width;

- Shoulder width;
- Gradients and their length;
- Truck and bus percentage of total traffic;
- Lateral obstructions on both or one side of the roadway; and
- Roadside friction.

The degree of roadside friction impact on road capacity is described as follows:

None: Few or no buildings along the roadside;

Light: Buildings and/or road intersections along and close to the road, 100-200 meters between these objects, pedestrians and non-motorized traffic observed occasionally;

Medium: Scattered roadside development, 50-100 meters between buildings and/or road intersections, pedestrians and non-motorized traffic observed frequently; and

Heavy: Continuous roadside development with less than 50 meters between buildings and/or road intersections, pedestrians and non-motorized traffic tend to disrupt the motor vehicle traffic and reduce travel speed to below 35 km/hr even at low traffic volume.

A number of road capacity and speed studies were carried out in the Philippines in the late 1970s, including the Iloilo City Bridge study in 1975, the Luzon Speed study in 1976-1977 and the Rosario-Cainta (Manila East Road) study in 1979.

On the Iloilo City Bridge about 28,000 vehicles per day were observed on a 7 meters wide carriageway with sidewalks, while around 32,000 vehicles per day passed a 7 meters wide carriageway with minimal shoulders and heavy to medium roadside friction on the Rosario-Cainta road section. The results of the speed studies are shown in the Highway Planning Manual, 1982 version, Volume 5 of a total of 8 Volumes.

These traffic volumes may be regarded as extremes, which can only happen when the peak hours are stretched out to most of the day with near-congestion situations most of the day. However, they also show ¾ and this is supported by the other surveys in Luzon ¾ that level E/F capacity under Philippine conditions is about 20 percent higher than that reported in the Highway Capacity Manual, which relates to a U.S.A. database. This could be due to the fact that the average passenger car unit in the Philippines is smaller than its US average counterpart and to different driver behavior, with the Philippine average driver often tailgating the vehicle in front.

When calculating VCR, the first step is to determine the Passenger Car Equivalent Factors (PCEF), which here are related to the basic vehicle types' PCEF in the absence of quality data on such features as shoulder width, gradients and their lengths, lateral obstructions along the roadway and roadside friction, all of which have a constraining influence on basic capacity. The traffic volume by type (see Chapter 3 in the National Road Traffic Survey Program Design Report, November 2002) multiplied by the respective PCEF constitutes the passenger car units (PCU), which in this context are not speed related.

Calculation of PCEFs

Vehicle Type		
No.	**Description**	**PCEF**
1	Motor-tricycle	2.5
2	Passenger car	1.0
3-5	Passenger and goods utility and small bus	1.5
6	Large bus	2.0
7	Rigid truck, 2 axles	2.0
8	Rigid truck, 3+ axles	2.5
9	Truck semi-trailer, 3 and 4 axles	2.5
10	Truck semi-trailer, 5+ axles	2.5
11	Truck trailers, 4 axles	2.5
12	Truck trailers, 5+ axles	2.5

PCU = SUM (AADT, VT1 x PCEF, VT1 + AADT, VT2 x PCEF, VT2 + ...+ AADT, VT12 x PCEF, VT12)

Calculation of Capacity (BHCC)

Carriageway Width	Hourly PCU	
	Rural	**Urban**
single < 4 meters	600	600
4-5 meters	1200	1200
5.1-6.0 meters	1900	1600
6.1-6.7 meters	2000	1700
6.8-7.3 meters	2400	1800
2 x 6.7 or 2 x 7.3 meters	7200	6700

The AADT by vehicle type must be forecast with traffic growth rates by year and vehicle type before the future PCU is calculated.

VCR = PCU*0.08/BHCC.

Legend:
AADT = annual average daily traffic;
BHCC = basic hourly car capacity (in PCU);
Hourly design volume = 8% of AADT in PCU;
PCU = passenger car units;
PCEF = passenger car equivalent factors; and
VCR = traffic volume-capacity ratio (0.00-1.00).

The rationale behind the PCEF system is as follows:

- Car, passenger van and owner-jeep: PCEF = 1 per definition.
- Motor-tricycle: PCEF = 2.5, because this slow-moving vehicle (25-30 km/hour as normal maximum speed) causes considerable queuing on roads particularly along areas with heavy roadside friction where stopping to load/unload passengers is frequent; shoulders and their condition would have an impact on the PCEF since the presence of a good paved

shoulder would attract these slow-moving vehicles. The stopping on the carriageway cause other vehicles to slow down and even stop and therefore the motor-tricycles (and jeepneys and buses) have a reducing effect on road capacity.

- Jeepney and small bus: PCEF = 1.5, because of relatively slow-moving and frequently stopping to load/unload passengers, particularly along heavy roadside friction areas (the heavier the roadside friction the more the potential for passengers and therefore the more stops). Running speed is at least higher then the motor-tricycle.

- Large bus: PCEF = 2.0 in flat terrain. Roadside friction is a factor to consider as for jeepneys, motor-tricycles and small buses. Shoulders normally do not have any impact as large buses usually stop at will on the pavement. Gradients would have a lowering impact on bus speeds. Carriageway and shoulder widths impact on road capacity for buses and trucks, especially for pavement widths of less than 6 meters. Lack of or limited shoulder and its condition also limit road capacity because it would imply the similarity of lateral obstructions.

- Trucks: PCEF = 2.0 for a rigid truck and 2.5 for a semi- or trailer-truck combination. As trucks do not stop regularly roadside friction is not a restraining factor but gradients and their lengths have a substantial effect on heavily loaded (or overloaded) trucks.

The daily capacity in both directions for a 7 meters (m) wide carriageway with adequate shoulder width (2-2.5 m on either side) in good condition and light to medium roadside friction would in flat terrain be about 16,000 vehicles at multiple peak-hour traffic, each one of no more than 8 percent of daily traffic. A similarly configured expressway (two lanes composing a carriageway) should be able to carry around 20,000 vehicles in both directions (a road with dual carriageway with median would have a capacity around 40,000 vehicles in both directions in rural areas). Traffic volumes exceeding these capacities could occur but only at low shares of heavy vehicles or by sacrificing the desirable travel hour to avoid heavy flows.

Capacity estimations have several purposes such as input to economic evaluation and forecast of VCR levels. A VCR of around 0.60 is considered the trigger for alerting the planners to think heavily about remedial measures (traffic management, road widening or bypass/diversion/flyover/ring road construction) to be implemented over the next five years to relieve congestion.

Overleaf are attached diagrams from the Cebu Pilot Test showing GIS examples of carriageway and bridge widths related to road capacity and VCR.