

COUNTING MOTORCYCLES AND ESTIMATING MOTORCYCLE VMT

I. Counting Motorcycles

Some Characteristics of Motorcycles

- Short
- Narrow
- Low metal content
- Possibly very low content of ferromagnetic materials
- Poor lane discipline
 - May avoid oil slicks in center of lane
 - May travel side by side
 - In some areas, may avoid congestion by traveling on shoulders or between lanes

Classification Technologies

Sources of potentially significant undercounts are in blue
Sources of potentially significant overcounts are in green

Inductive loops and piezoelectric sensors

- General
 - Some undercounting due to side-by-side operation of motorcycles
 - Conventional loops and piezos – undercounting due to poor lane discipline
 - Wide loops (with upgraded electronics) and full-lane-width piezos – possible undercounting due to operation between lanes or on shoulders
- Classification based on axle spacing
 - Difficulty distinguishing motorcycles from subcompact autos (could be addressed by installing piezos diagonally)
 - Recommended axle-spacing threshold for distinguishing motorcycles – 6 feet (2)
 - Axle-spacing thresholds above 6 feet (used by some states) result in significant overcounting of motorcycles
- Classification based on magnetic length
 - Difficulty distinguishing motorcycles from very short autos (Smart ForTwo)
 - Recommended magnetic length for distinguishing motorcycles – 6 or 7 feet (3,4)
 - Loops without piezos – possible counting of vehicles that are changing lanes as motorcycles

Road Tubes

- Difficulty distinguishing motorcycles from subcompact autos
- Recommended axle-spacing threshold for distinguishing motorcycles – 6 feet (2)
- Axle-spacing thresholds above 6 feet (used by some states) result in significant overcounting of motorcycles
- May fail to detect very light motorcycles
- In very light traffic, motorcycle operators may drive around tubes

Magnetic detectors

- Undercounting can be significant, especially for single-probe and dual-probe detectors
- One test of single- and dual-probe detectors found 65% undercounting (5)

Pole-mounted video

- Missed motorcycles and phantom counts tend to offset each other under certain conditions (1,6,7,8)
- Reasonably good counts when motorcycle volumes are moderate to high and truck volumes are low (6,8)
- Likely overcounting when motorcycle volumes are low
- Undercounting due to occlusion when truck volumes are high (5)
- Nighttime use requires artificial lighting and system may have difficulty with glare and shadows
- Inappropriate for foggy locations

Pole-mounted radar

- Accuracy likely to be similar to pole-mounted video
- Does not require artificial lighting; can be used in fog

TIRTLS (The Infra Red Traffic Logger)

- Slight overcounting (about 5%) when transmitters and receivers are less than 40 feet apart (9, 10)
- Significant overcounting (>50%) when transmitters and receivers are more than 67 feet apart (9,11)

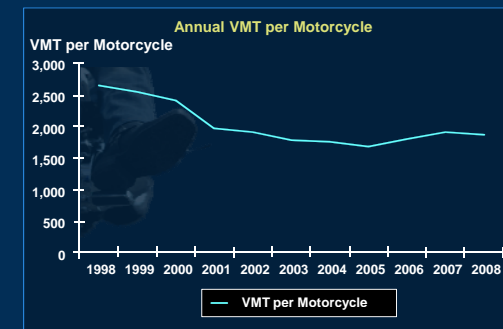
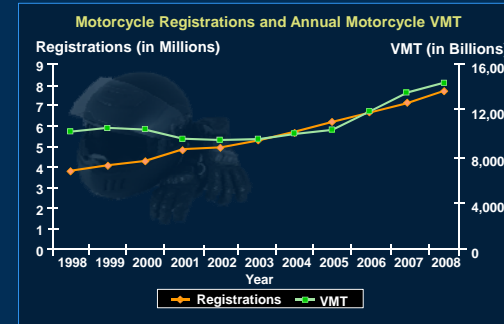
Recommended Technologies

For all purposes – length classification using wide inductive loops with upgraded electronics and full-lane-width piezos

For developing seasonal and day-of-week factors – length classification using conventional loops and piezos. (Though conventional loops and piezos are likely to undercount motorcycles, the undercounting is likely to be reasonably consistent throughout the year)

Perhaps – for short counts at selected locations – pole-mounted video. (Requires further evaluation. Not appropriate where motorcycle volumes are low or truck volumes are high)

II. Count-Based VMT Estimates



Influences on Average Annual VMT per Motorcycle

- 2005-2008 – 11% increase
 - Apparently caused, to a significant extent, by large increases in sales of subcompact cars in 2006 (40%) and 2007 (20%). (These vehicles are sometimes misclassified as motorcycles by axle classifiers)
 - May also be affected by increase in the number of states submitting estimates of motorcycle VMT in 2007 and 2008. (National VMT estimates are designed to reflect VMT in all states, but the adjustments for non-submitting states may be inaccurate)
- 1998-2005 – 36% decrease
 - Apparently caused, in part, by a secular shift away from use of road tubes (which tend to overcount motorcycles) toward technologies that produce undercounts or smaller overcounts
 - May also be caused, in part, by reductions in the axle-spacing thresholds used by some states for distinguishing between motorcycles and autos

III. Registration-Based VMT Estimates

Limitations

- Requires a source of data on motorcycle populations – from annual/biannual registrations or from insurance-company records
- Produces estimates of VMT of registered (or insured) motorcycles, which may be smaller than VMT of all motorcycles. Discussed further below
- Produces estimates of all VMT, not just on-road VMT
- VMT will be underestimated in states where MC rallies result in a significant amount of VMT by out-of-state MCs
- Registration records in some states may not distinguish between MCs and some specialized types of 4-wheel vehicles (such as all-terrain vehicles)
- A registration-based system by itself would not produce VMT estimates by roadway functional class

Advantages

- A registration-based system could produce separate estimates for different types of motorcycle and/or for different engine sizes – useful information for analyzing the relation between vehicle design and motorcycle safety
- Registration-based estimates could be used for a multiyear interim period during which full-lane-width loops are being phased in
- Comparisons of simultaneously developed count-based and registration-based VMT estimates could provide insight into the weaknesses of the two estimation procedures and into options for improving the procedures

Unregistered Motorcycles

Some observers believe that the number of motorcycles in use is higher than the number of registered motorcycles

Possibilities for unregistered motorcycles

- Not in use
- Only used off road and/or on private roads
- Operated on public roads without a license tag
- Operated on public roads with a borrowed tag (e.g., the owner of multiple motorcycles registers only one motorcycle but shares the tag)

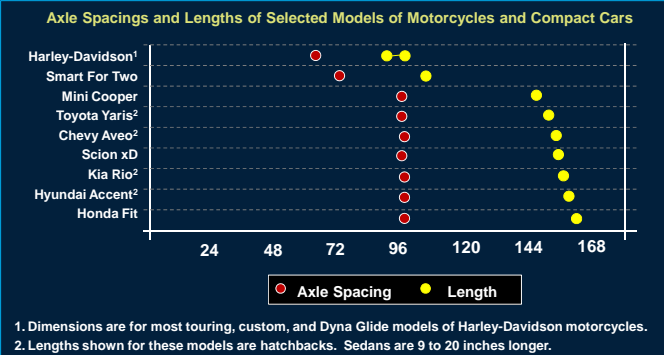
For purposes of estimating on-road crash, injury and fatality rates, only (c) and (d) are issues

This issue could be addressed by modifying crash records to distinguish between crashes of registered and unregistered motorcycles

Annual VMT per Vehicle

Can be estimated from

- Odometer readings obtained during periodic inspections (where required)
- Insurance company records of reported odometer readings (obtained annually)
- Registration records that include reported odometer readings (may require legislation)



1. Dimensions are for most touring, custom, and Dyna Glide models of Harley-Davidson motorcycles.
2. Lengths shown for these models are hatchbacks. Sedans are 9 to 20 inches longer.

Detection and Classification Issues

- Poor lane discipline –
 - May be missed by piezos, loops, and other detectors that cover only part of a lane
 - In some areas, may operate between lanes or on shoulders when road is congested
- Axle spacing – cannot reliably distinguish motorcycles from subcompact autos on basis of axle spacing
- Vehicle length – Somewhat easier to distinguish MCs from subcompact autos on basis of magnetic length (as measured by inductive loops) than on basis of axle spacing – partly because differences in (physical) length are somewhat greater; and partly because, for vehicles with low metal content, magnetic length is shorter than physical length. (MCs generally have a magnetic length that is at least 3 feet shorter than their physical length(3).)
- (Vehicle) occlusion – for roadside systems, large vehicles in one lane may prevent detection of smaller vehicles in the next lane
- Wheel occlusion – for roadside wheel-detection systems, wheels in one lane may prevent detection of wheels in other lanes

