

Turning Vehicle Maneuvers: International Comparison

Evaluating turning vehicle maneuvers at crosswalks in the US and Japan



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Objectives and Methodology

To increase traffic safety better understanding of turning vehicles behavior and crossing pedestrians behavior is needed. As a contribution to this knowledge video data on intersections in the United States (US), New York City and Japan, Nagoya were collected and analyzed.

The most important aspects of vehicle turning behavior are **trajectories of turning vehicles** and **vehicle turning speeds**.



Data Collection and Processing

Speed profiles and relevant trajectories of near-side turning vehicles were analyzed using a video tracking program. Three phases of turning maneuver are considered:

- **(CS-1) Drivers arriving at the upstream stop line**
- **(CS-2) At the middle of the turn**
- **(CS-3) At the inside edge of the exit crosswalk**

Vehicle maneuvers are strongly dependent on geometry and traffic situation.

Range of geometry and traffic parameters

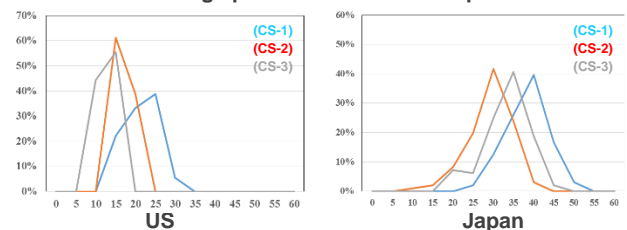
	US	Japan
Crosswalk length (m)	9.8 – 35.7	15.8 – 35.5
Crosswalk width (m)	4.6 – 6.1	5.3 – 6.8
Angle between entering and exit approaches (°)	90 – 138	66 – 108
Corner radius (m)	3.7 – 4.6	10.0 – 21.0
Number of exit lanes	3 – 4	2 – 3
Crosswalk setback distance (m)	5.8 – 6.1	7.9 – 13.4
Cycle length (s)	90 – 150	140 – 160
Vehicle volume (vehicles/hr)	0 – 180	75 – 344
Pedestrian volume (pedestrians/hr)	32 – 2192	0 – 72

Vehicle Turning Speeds at Crosswalks

The large intersections in Japan allow drivers to maneuver easily and travel at higher speeds than compact normalized intersections in the US. The average speeds are:

- **US: from 11.2 (3.1) to 14.4 km/hr (4.0 m/s),**
- **Japan: from 19.6 (5.4) to 30.3 km/hr (8.4 m/s).**

Turning speed distribution examples



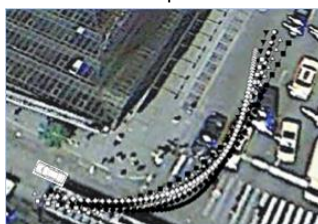
Turning Path Variations

The observed vehicle paths show significant variations in the uncongested and congested flow conditions. This indicates that assuming static or fixed vehicle turning paths for the design and analysis of intersections is unrealistic.

Turning Vehicle Trajectories

Peak

Non-peak



Findings

- The **trajectory** and **speed** of turning vehicles are good indicators for determining unsafe pedestrian–vehicle conflicts.
- Near-side turning **speeds** are based on **geometric features** such as turning radii, channelization treatments, angles between entering and exit approaches, and crosswalk locations.
- In general, the **distributions of potential conflict points** with pedestrians (CS-3) at Japanese sites are significantly **wider** than those of the sites in New York City.
- **Trajectories** of observed turning vehicles in US show significant variations in the **uncongested and congested** flow conditions.
- A **speed distribution** of near-side turning vehicles at the initial stop bar (CS-1) is **equal or higher** than those at the middle of the turn (CS-2) and at the inside edge (CS-3) of the exit crosswalk, whereas it has the **narrowest distance** from curb.

For the further study, more information about the influence of various pedestrian density levels on turning vehicle behavior should be obtained.

