REPORT OF RESEARCH RESULTS

(a) **Title** : A Comparative Evaluation of Speed Reduction Devices

(b) **Primary Researcher** : Miss.NAPAT LEKAWATTHANA
Transportation Engineering, Center for Applied Transportation and Logistics Technology
Suranaree University of Technology

Co-researcher(s) : Dr.SIRADOL SIRIDHARA
Lecturer, School of Transportation Engineering,
Suranaree University of Technology

(c) **Summary** :

Road accidents in Thailand have become a severe problem that causes significant propertydamage, injuries and fatalities, including ensuing loss of opportunity costs. The Royal Thai PoliceInformation Center reveals that 74,668 road accidents in 2011 claimed 7,248 death tolls and caused 1,961,998,143 baht of property damage. One of the main reasons of the road accidents is speeding overan allowable speed limit. Speed reduction measures shall be a key factor to decrease the number andseverity of accidents. This will also enhance safety and encourage more pedestrian activities.

This research aim to create a safe environment for a university by vehicle speed reduction. It is made possible by various types of traffic calming devices. Two of the most widely used devices are speed humps and speed tables which slow vehicles down with a vertical barrier. The dimension of these devices should be design properly so that they effectively reduce vehicle speed to a target value. This study shall evaluate and compare effectiveness of different types of speed humps or tables of different shapes. Three types of traffic calming devices namely speed bumps, cushions and speed humps shall be tested for speed reduction ability. A statistical hypothesis test shall be apply to proof the speed difference before and after installation.

(d) **Aim of Research** :

To evaluate effectiveness of different types and dimensions of speed humps and speed tables.

(e) **Method of Research & Progression** :

Data will be collected at two selected locations. Data collection will be conducted 7 days before the installations and 7 days after installation to allow road users to adjust their driving and walking behaviors to a normal state after the devices are placed. Speeds will be collected in the morning, midday and evening peak hours. The vehicle speed distribution shall be assumed normally variated around a mean, and the standard deviation of the sample shall be assumed equal to that of the whole population. To ensure that data can represent true characteristics of the whole population, the number of sample size will be checked with the standard deviation of the data set according to the following equation:

$$n = (Z_{(1-\frac{\alpha}{2})}\frac{\rho}{e})^2$$

where n = sample size
Z = standardized Z-score for normal distribution
σ = standard deviation of the sample
e = allowable error, in this study ±5 km/hr.

Speed difference before and after installation shall be tested by a statistical tool namely t-test. A t-test , a proven tool for comparing means of two dependent sample groups. It is hypothesized that the Speed difference before and after installation shall are difference or not?.

T-test

$H_0 : \mu_1 = \mu_2$
$H_1 : \mu_1 \neq \mu_2$

Where μ_1 = Speed before installation shall
μ_2 = Speed after installation shall
Determine critical t where α = 0.05

(f) Results of Research :

Table 1 show the 85th percentile speed at various stages. Found that 40 to 20 meters before the hump the speed are not different. And is reduced in the last 20 meters to the hump and will speed up again after the hump.

Table 1 : The 85th percentile speed at various stages

Location	Type	Before (km/h)	Case	Speed 85th percentile (km/h)										
				Before Hump (m.)				Speed Hump (m.)			After Hump (m.)			
				40	30	20	10	2.5	0	2.5	10	20	30	40
Witthayavitee	MC	42	1	41	40	28	17	-	14	-	21	32	43	45
			2	43	40	26	16	13	-	15	19	28	36	37
			3	35	34	26	17	-	13	-	16	26	33	35
	Car	50	1	40	40	31	23	-	15	-	21	31	35	37
			2	38	37	25	18	14	-	15	20	26	32	34
			3	31	31	24	17	-	13	-	17	21	27	28
Mahawtthayalai3	MC	44	1	36	34	29	18	-	14	-	18	25	32	34
			2	37	35	27	16	13	-	14	18	24	33	35
			3	40	38	31	20	-	16	-	22	30	36	37
	Car	50	1	40	40	30	20	-	16	-	21	27	38	40
			2	36	34	26	17	14	-	15	20	26	34	36
			3	32	32	22	16	-	13	-	18	25	33	35

Table 2 : Two-Sample Assuming Unequal Variances

Location	Type		Case1	Case2	Case3	Case1 VS Case2	Case2 VS Case3	Case1 VS Case3
Witthayavitee	MC	t Stat	19.84	27.45	23.96	9.57	-2.38	6.67
		t Critical one-tail	1.65	1.65	1.66	1.66	1.68	1.67
		t Critical two-tail	1.97	1.97	1.98	1.98	2.01	2.00
	CAR	t Stat	35.26	41.10	45.34	8.91	2.14	12.23
		t Critical one-tail	1.65	1.65	1.65	1.67	1.68	1.68
		t Critical two-tail	1.97	1.97	1.97	2.01	2.02	2.01
Mahawtthayalai3	MC	t Stat	25.51	36.41	22.46	4.29	-8.00	-2.98
		t Critical one-tail	1.67	1.65	1.67	1.70	1.70	1.69
		t Critical two-tail	2.00	1.97	1.99	2.05	2.04	2.02
	CAR	t Stat	29.75	29.75	33.49	9.38	0.56	8.03
		t Critical one-tail	1.65	1.65	1.65	1.67	1.68	1.68
		t Critical two-tail	1.97	1.97	1.98	2.00	2.02	2.01

Table 2 show Two-Sample Assuming Unequal Variances. found all cases the t Stat is always greater than t Critical. Therefore reject H_0 and accept H_1 all. So avery case are different speeds significant at 0.05.

Speed bumps is a physical obstruction that promotes road safety in places like universities and gated community.

We found that Case 2 is the most effective tool for speed reduction, but the difference is minimal.

(g) Future Areas to Take Note of, and Going Forward :

We planned a public relation program with the responsible unit to inform students of the speed bump installation. Proper warning signs was installed on both sides. Despite all these measures, a couple of motorcyclist almost fell down during the test. Also, motorcycles and vehicles had hard time running through speed bumps, especially the second type. So tradeoffs between safety and ride comfort should be taken into account.

(h) Means of Official Announcement of Research Results :

We will submit our research to gather comments in reputable transportation Journal. now we already submitted the research abstract for approval and are waiting to submit the full paper in SWU Engineering Journal. We expect the publication in the Journal of SWU Engineering Journal (2013) Vol 8.