

Application of the Theory of Planned Behavior to Predict Young Drivers' Speeding Behavior

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Abstract: The efficacy of an extended theory of planned behavior was evaluated in the young drivers' (N=800) speeding behavior and intention to speed. The results show that young drivers' speeding behavior appears to be affected by perceived behavioral control, past behavior, personal norms, intention to speed, affective and evaluative attitude towards compliance with speed limit, and social support. It also found that the impact of personal norms is greater in the intention to speed. Furthermore, the effect of socio-economic characteristics and the vehicle usage such as gender, age, income level, university type, and location of university etc. were significant factors to report that young drivers are more likely to be speeding offenders. Interestingly, racing movies and racing also make important predictors to influence drivers to drive exceeding the speed limit.

Keywords: theory of planned behavior, speeding behavior, young driver

1. INTRODUCTION

In Thailand, it is well known that one of the most important factors contributing to the traffic crashes and the severity of road crashes is speeding. From the years 2001 to 2010, speeding involvement has been reported to be as high as nearly 80% of all traffic crashes on national highways, and about a two-third of fatal crashes on national highways was related to speeding. These crash and fatality risks associated with speeding are practically reflected by the fact that speed limit is very often violated on a large scale in Thailand. Some recent roadside surveys for the speed limit compliance rate show that 40% to 70% of the car drivers typically exceed the speed limit of 90 kph on highways (Siwarochana et al., 2004; Kulleab et al., 2006; TARC, 2008; DOH, 2009). Kanitpong et al. (2011) report the significant factors influencing speed choice of 2,180 Thai drivers which include age, education, income, vehicle type used, vehicle age, travel distance, driving experience, and attitude towards speeding behavior. It is interesting to see that younger drivers tend to drive faster than older drivers, and the drivers with higher education or higher income tend to drive faster. Moreover, car drivers are more likely to drive faster than other vehicle types.

Many previous research studies also found that young drivers tend to drive faster than other age group of drivers (Stradling and Meadows, 2001; Fleiter et al., 2010) and consequently, young drivers have higher risk of road crashes than other age group of drivers (Hasselberg and Laflamme, 2005; Clarke et al., 2010). Literature review suggests the need for implementing more effective countermeasure to control speeding behavior of young drivers. However, the effectiveness of such measures depends mainly on how well we can change speeding behavior of young drivers. Thus, it is necessary to understand the reason of speeding in the group of young drivers by examining their intention to speed and their driving behaviors. Many studies have been conducted to evaluate drivers' speeding behavior and intention to speed, but those studies did not focus on young drivers who have different driving characteristics than other groups of drivers. Therefore, this paper attempts to understand young drivers' speeding behavior by using the Theory of Planned behavior (TPB) and additional variables that are related to speeding behavior, in the context of Thailand. The objectives of this study are as follows:

1. To determine the significant influencing factors to the speeding behavior of young drivers.
2. To predict and explain young drivers' intention to speed and their speeding behavior by using the extended TPB constructs with additional predictors relating to young drivers' speeding behavior.

2. THEORY OF PLANNED BEHAVIOR (TPB)

2.1 TPB Concept

One of the social psychology models that is used to identify the human behavior is the Theory of Planned Behavior (TPB). The theory of planned behavior (TPB) was extended from the theory of reason action (TORA) developed by Ajzen (1991). At present, the TPB is considered as the best predictor of human's behavior because it provides potential predictors for identifying significant factors relating determination. The TPB model consists of attitude, subjective norms, and perceived behavioral control (PBC) that are related to the intention to perform or not perform

activities. Firstly, attitude towards the behavior refers to the degree to which a person has a likable or unlikable evaluation or estimation of the behavior in question. Secondly, subjective norms refer to the normative expectation of others such as family members and closed friends who have influence on the inspiration to comply with their expectations. Finally, perceived behavioral control (PBC) describes behavior which refers to the degree of human's feeling that they can control and perceive the consequence of their behavior. The attitude towards the behavior, subjective norm and PBC directly predict the intention which is the central factor in the TPB model. It refers to the individual's intention to perform activities. PBC combines with behavioral intention can be also used to directly estimate the behavior.

The utility of the Theory of Planned behavior (TPB) and the Theory of Reason Action (TORA) have been used to describe human behavior in many studies. Within the field of traffic safety and injury prevention, most studies apply the TPB to observe the behavioral explanations. For example, to understand drivers' speeding intention, the predictors in the TPB including attitude, subjective norm and PBC can be applied in order to investigate why drivers tend to drive with higher speed. However, it has been proved that these three independent determinants of intention (attitude, subjective norm, and PBC) are not enough to explain the behavior, and thus there are shortcomings to predict drivers' speeding behavior using TPB model.

2.2 Extended TPB to Predict Drivers' Speeding Behavior

It is well known that the TPB is a useful model for understanding the human behavior. However, in the field of traffic safety and injury prevention, several factors significantly contribute to drivers' behavior prediction. Three TPB constructs (attitude, subjective norms, and PBC) can be used to predict and explain the speeding behavior, but the methodology has not been applied in the validity prediction for drivers' speeding behavior due to the lack of some related explainable factors. Recent studies show that past behavior, descriptive norm, and personal norm directly affect intention (Hamilton and White, 2008; Elliott and Thomson, 2010; Forward, 2009; Pelsmacker and Janssens, 2007). Furthermore, many research indicated that attitude towards behavior should be distinguished to affective attitude and evaluative attitude in order to achieve the best understanding (Ajzen, 1991; Pelsmacker and Janssens, 2007).

Affective attitude towards drivers' behavior refers to the negative or positive feeling obtained when the driver drives exceeding the speed limits, while evaluative attitude towards drivers' behavior refers to the consequence of exceeding the speed limits (Elliott and Thomson, 2010). Past behavior can be explained that drivers who usually drive at high speeds tend to drive using high speed in the future. The relationship between past behavior and future behavior is an evidence of the behavioral stability. In addition, past behavior predictor should be independent of other effects from the existing predictors within TPB model. TPB normally considers the subjective norms which explain that the behavior is influenced by the person who is important to you such as family members and friends. However, in case of traffic situation, drivers may infer the opinion or norm of other road users. Therefore, there are many factors related to drivers' behavior that are not included in the TPB model such as past behavior, social support, and enforceable devices support.

This study attempts to extend the TPB constructs by including additional predictors relating to young drivers' speeding behavior for predicting and explaining young drivers' intention to speed and their speeding behavior. The additional predictors should provide

advantages in order to support the model for better prediction and should be incorporated with each variable within the existing model. Two predictors were added based on their influencing factors related to speeding behavior. These factors include the response to speed enforcement and the social support. Firstly, the response to speed enforcement factor is added to the model to determine the drivers' response to the speed enforcement such as installation of speed warning/posted speed limit signs, speed enforcement zone by traffic polices, and speed camera that can enforce the drivers to comply with the speed regulation. Secondly, for the social support, this factor is to indicate the degree of drivers' belief when receiving influences or suggestions from others and to examine drivers' speeding behavior while they are driving with some passengers in their car. Therefore, this model assumes a total of nine conceptually independent determinant of intention which can be constructed in the diagram as shown in Figure 1.

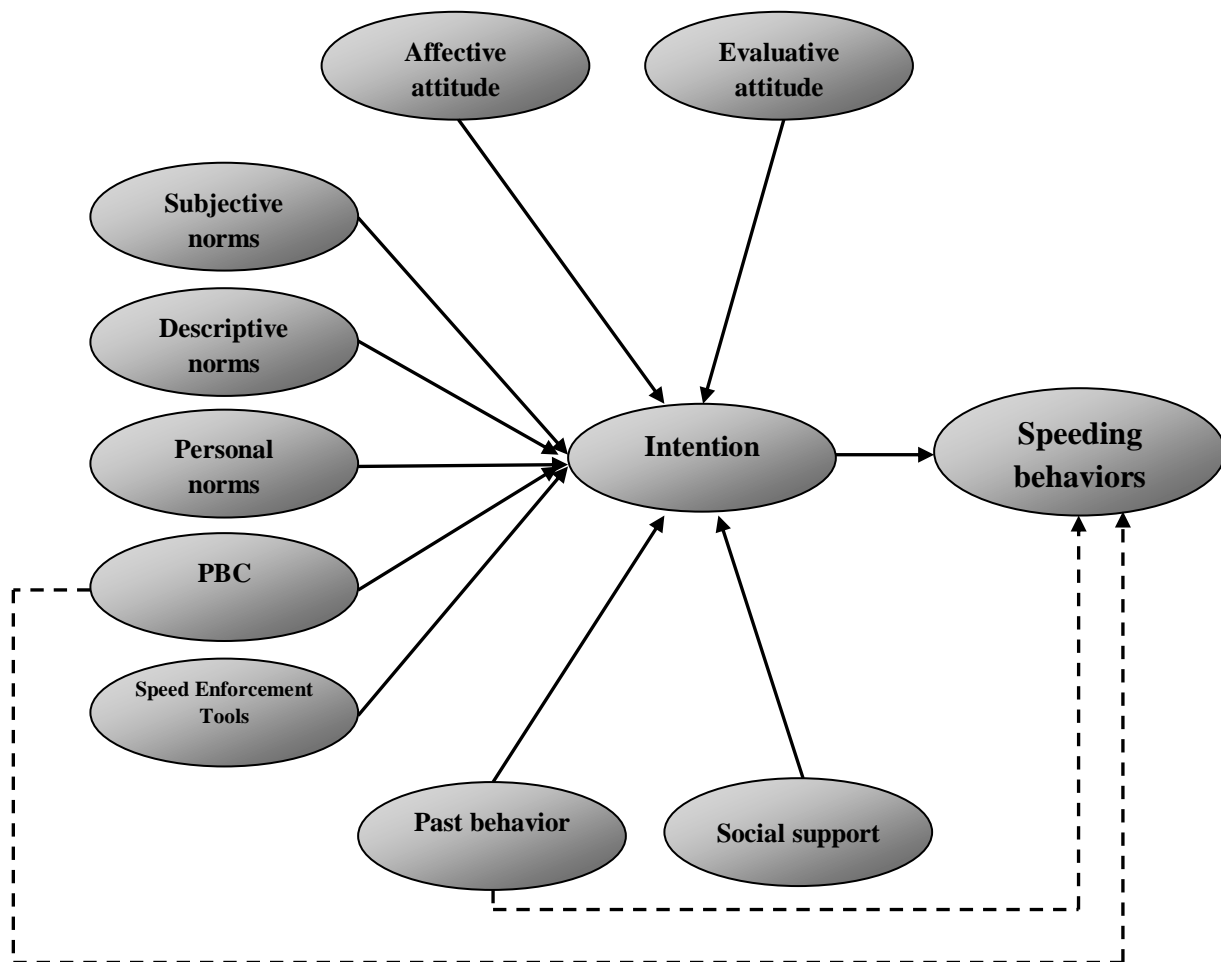


Figure 1. Young drivers' speeding behavior model

3. METHODOLOGY

Self-report survey was conducted on college student drivers whose ages are in the range of 18-25 years old who intend to drive exceeding the speed limit, and tend to have higher record for speeding-related accidents. The data collection was designed to select the targeted group by considering four variables including of university type (public and private university), university location (urban and suburban areas), annual household income (lower than \$40,000 and greater than \$40,000), and driving experience (less than 3 years and more than 3 years). A total of 800 samples were selected in this study with 50 drivers of each designed group. Table 1 shows the data collected in this study.

Table 1. Number of samples collected based on the experimental design

Criteria	Number of Samples															
	Public University								Private University							
Type	Public University								Private University							
Location	Urban				Suburban				Urban				Suburban			
Household Income	Low Income		High Income		Low Income		High Income		Low Income		High Income		Low Income		High Income	
Driving Experience	<3	>=3	<3	>=3	<3	>=3	<3	>=3	<3	>=3	<3	>=3	<3	>=3	<3	>=3
Male	17	14	23	15	27	17	29	21	21	15	31	18	23	9	22	21
Female	33	36	27	35	23	33	21	29	29	35	19	32	27	41	28	29
Total	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
800 samples																

The self-report questionnaire form was designed to comprise of five sections. For the first section, the questions are related to the driver socio-economic characteristics such as age, gender, university type and location, and annual household income. The second section includes two sub-sections which are driving experience and vehicle use characteristics. The questions in the first sub-section include driving experience in number of years, experience of receiving speeding ticket, and traffic accident experience. The second sub-section includes the questions about vehicle use characteristics such as vehicle type/model and vehicle age. For the third section, the drivers were asked about their average speed normally used on national highways in urban and suburban areas, and on motorways. This question was asked to observe the speeding behavior of drivers. The fourth section includes questions related to the activities mostly performed by young drivers, and these activities tend to influence their speeding behavior such as watching auto racing movies and seeing auto racing. Finally, the questions in the last section were designed to measure the extended TPBs' predictors which are related to speeding behavior, especially for young drivers. A Likert's scale was used to obtain ratings which can quantitatively estimate young drivers' opinion. The drivers were questioned to rate the questions in 11 categories by using the five-point Likert's Scale. The questions in 11 categories are summarized in Table 2.

Table 2. Questions designed to measure the extended TPBs' predictors

Categories	Description	Examples
1. Affective attitude (AFF)	To predict the negative or positive feeling of car drivers who performs the speeding	Driving fast helps you to arrive at your destination more quickly (strongly agree - strongly disagree)
2. Evaluative attitude (EVA)	To indicate about the expected consequence when the drivers drive using high speed	Drive fast is expensive (strongly agree - strongly disagree)
3. Subjective norms (SUB)	To present the normative expectation of others who are important to each driver	My parents think that you should comply with speed limit (never - all times)
4. Perceived behavioral control (PBC)	To indicate the performance of the drivers whether they can drive using high speed	If you prefer to drive exceeding the speed limit, you can do it (not at all - all times)
5. Past behavior (PAS)	To predict future behavior under the assumption that the drivers who usually using the high speed, they tend to drive with high speed frequently	In the past 3 months, I drive exceed speed limit (never - all times)
6. Social support (SOC)	To show the level of drivers' belief when they receive some comments and/or suggestion from others	Would you family members approve/disapprove when you driving exceed the speed limit (definitely disapprove - definitely approve)
7. Response to speed enforcement (ENF)	To investigate about the drivers' response to traffic enforcing devices (ex. speed limit signs, warning signs)	I comply with posted speed limit (never - all times)
8. Descriptive norms (DES)	To determine the effects of other road users influencing on drivers	Respecting the speed limits incite other drivers to drive closely to your car (strongly agree - strongly disagree)
9. Personal norms (PER)	To show the individual's attitude about your driving behavior and the driving behavior of other road users (Self-standard)	I drive like other drivers (strongly agree - strongly disagree)
10. Intention (INT)	To predict the drivers' intention to drive exceeding the speed limit	I intent to drive exceeding the speed limit (never - all times)
11. Behavior (BEH)	To explain about the drivers' behavior who prefer to speeding	In the past 3 months, how many times do you exceed posted speed limits (never - all times)

4. RESULTS AND ANALYSIS

4.1 Influencing Factors Affecting Speeding Behavior of Young Drivers

The multiple linear regression model was applied to analyze the key attributes influencing speeding behavior of young drivers. In this study, the dependent variable is the average speed that young drivers normally used on national highways in urban and suburban areas and on

motorways. The independent variables considered in the analysis include socio-economic characteristics of the drivers, driving experience, vehicle use characteristics, activities mostly performed, and attitude towards speeding behavior. However, the test of multicollinearity indicates the existence of strong correlation among the variables: driver age and driving experience in number of years (i.e. the pair-wise correlation coefficient is higher than 0.6). Thus, driving experience in number of years was eliminated from the analysis. Table 3 shows the definitions of the independent variables remaining in the analysis.

Table 3. Independent variables in the multiple linear regression analysis

Variables	Abbreviation	Definition	
Driving speed (km/h)	Speed	Continuous variable	
Gender	GEN	0 = Female	1 = Male
Age	AGE	Continuous variable	
University type	UNI	0 = Public	1 = Private
University location	ULO	0 = Urban	1 = Suburban
Annual household income	INC	0 = Low	1 = High
Driving Experience (years)	EXP	Continuous variable	
Driving License	LIC	0 = No	1 = Yes
Experience of receiving speeding ticket	TIC	0 = Never	1 = ≥ 1 time
Traffic accident experience of family member due to speeding	ACF	0 = Never	1 = ≥ 1 time
Traffic accident experience due to speeding	ACC	0 = Never	1 = ≥ 1 time
Habits of watching auto racing movies	MOV	0 = Never, Rarely	1 = Sometime, Often
Habits of seeing auto racing	RAC	0 = Never, Rarely	1 = Sometime, Often
Affective attitude towards compliance with speed limit	AFF	Negative – Positive (1 to 5)	
Evaluative attitude towards compliance with speed limit	EVA	Negative – Positive (1 to 5)	

Model 1 was used to evaluate the influencing factors affecting speeding behavior of young drivers on national highways in urban area. The regression analysis results of Model 1 were presented in Table 4. It is evident from the model that the significant factors influencing speeding behavior on national highways in urban area are gender, age, university type, university location, annual household income level, habits of watching auto racing movies, habits of seeing auto racing, and affective attitude towards speeding. The coefficients of these variables are statistically significant at 1-10% level; however, the signs are varied depending on the effect of each variable. Female young drivers are more likely to drive faster than male. Young drivers who study in private university and the university located in suburban area tend to drive faster. The location of university can represent the chance of young drivers to use higher speed. Young drivers with high household income are more likely to drive faster than drivers with lower household income. Young drivers who like to watch auto racing movies or see auto racing tend to drive faster. Lastly, young drivers with negative affective attitude towards compliance with the speed limit are more likely to drive faster.

In Model 2, the influencing factors affecting speeding behavior of young drivers on national highways in suburban area were analyzed, and the results are shown in Table 4. The significant factors influencing speeding behavior on national highways in suburban area include age, university type, annual household income level, driver license holding, experience of receiving speeding ticket, habits of watching auto racing movies, habits of seeing auto racing, and affective attitude towards speeding. The result of the multiple regression model shows that all these factors were significant at 1-10% significance level. In model 2, it is evident that young drivers who have driver license and have experience of receiving speeding ticket are more likely to drive faster. In addition, other results show similar trend as found from the analysis of Model 1.

Model 3 was used to evaluate the influencing factors affecting speeding behavior of young drivers on the motorways which is the highest class of highways in Thailand. The coefficients of the variables: gender, university location, annual household income level, experience of receiving speeding ticket, traffic accident experience due to speeding, habits of watching auto racing movies, habits of seeing auto racing, affective and evaluative attitude towards speeding are statistically significant at 1-10% level. Male drivers tend to drive faster than female drivers. Young drivers who study in the university located in suburban areas are more likely to drive faster. Young drivers with high household income are more likely to drive faster on the motorways. Young drivers who have experience of receiving speeding ticket, experience of traffic accident due to speeding, and have habits of watching auto racing movies and seeing auto racing tend to driver faster. Lastly, young drivers who express their negative affective and evaluative attitude towards compliance with the speed limit are more likely to use higher speed.

Table 4. Coefficients of Multiple Regression Model for speeding behavior analysis

Variables	Model 1 National highways in Urban			Model 2 National highways in Suburban			Model 3 Motorways		
	Coeff.	P>[z]		Coeff.	P>[z]		Coeff.	P>[z]	
Gender (GEN)	-3.915	0.013	**	1.324	0.405		3.851	0.025	**
Age (AGE)	-1.262	0.006	***	-1.077	0.020	**	-0.577	0.244	
Type of University (UNI)	5.042	0.001	***	4.770	0.002	***	0.929	0.576	
University's Location (ULO)	4.120	0.008	***	2.430	0.122		4.318	0.011	**
Income Level (INC)	3.502	0.023	**	5.671	0.000	***	4.005	0.017	**
Driving License (LIC)	-0.329	0.867		3.386	0.092	*	3.957	0.086	
Experience of receiving speeding ticket (TIC)	2.205	0.236		5.388	0.004	***	6.789	0.001	***
Experience of involving in accident of family member due to fast driving (ACF)	-2.208	0.175		-2.437	0.141		0.747	0.673	
Experience of involving in accident due to fast driving (ACC)	1.123	0.616		3.174	0.161		4.588	0.059	*
Frequency of racing movies viewing (MOV)	3.060	0.061	*	3.686	0.026	**	3.842	0.030	**
Frequency of racing viewing (RAC)	3.773	0.039	**	3.854	0.035	**	7.537	0.000	***
Affective attitude (AFF)	-3.156	0.000	***	-5.280	0.000	***	-4.630	0.000	***
Evaluative attitude (EVA)	-0.909	0.181		-0.304	0.658		-1.521	0.039	**
Constant	112.9	0.000	***	133.5	0.0000	***	127.57	0.0000	***
Number of observation	743			727			673		
R-squared	0.1076			0.1709			0.1847		
Adj R-squared	0.0917			0.1558			0.1686		
Root MSE	20.185			20.214			20.890		

Note: *** indicates significance at the 1% level. ** indicates significance at the 5% level. * indicates significance at the 10% level.

4.2 Analysis of Speeding Behavior Using the Extended Theory of Planned Behavior

To explain young drivers' speeding behavior by using the existing TPB constructs and additional predictors, the structural equation modeling (SEM) was applied in the analysis. A path analysis was used to determine the relationships between the variables. The path coefficients that specify the relationships between the TPB model constructs were examined in relation to speeding behavior (BEH) and speeding intention (INT). The existing TPB constructs and additional predictors include affective attitude (AFF), evaluative attitude (EVA), descriptive norms (DES), personal norms (PER), perceived behavioral control (PBC), past behavior (PAS), social support (SOC), and response to speed enforcement (ENF).

The model is hypothesized that the speeding behavior (BEH) of young driver can be predicted by 8 exogenous variables via intention (INT) as described, and also directly predicted by PAS and PBC as shown in Figure 2. The model analysis shows an adequate goodness of fit of 0.942.

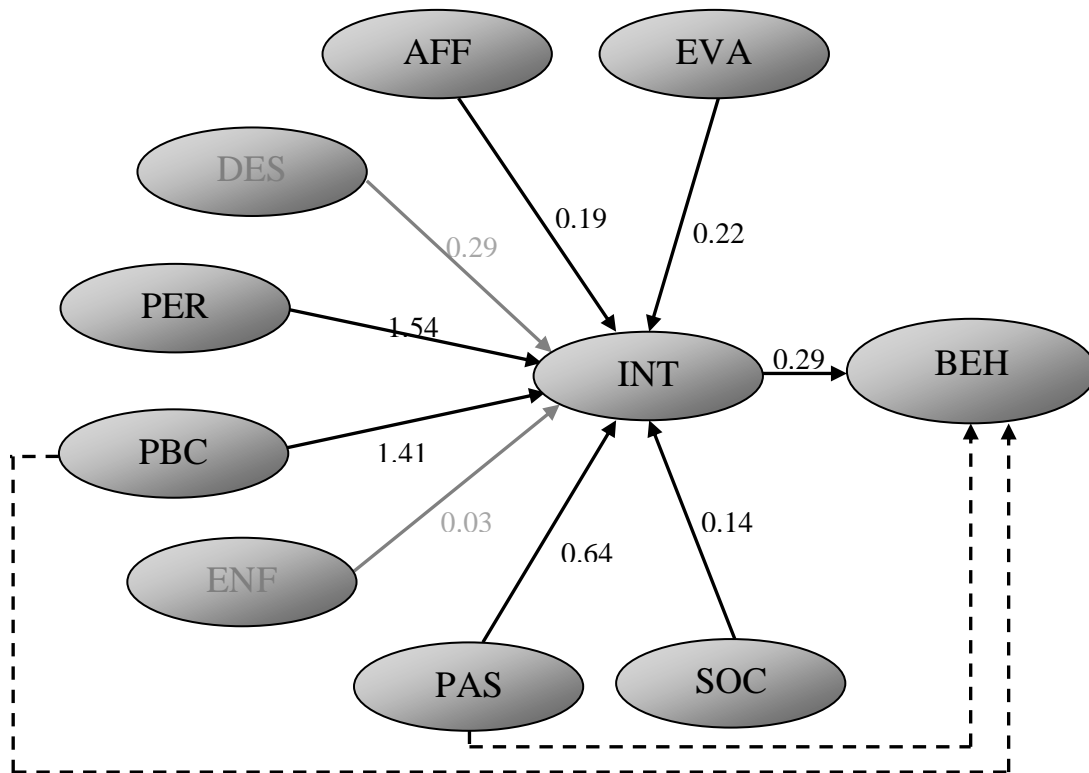


Figure 2. Path analysis of the Extended TPB factors and their prediction

According to the path diagram presented in Figure 2, most variables are significant estimators and have direct and indirect impact on speeding behavior. Based on the results shown in Table 5, it appears that three main factors affecting the intention to speed (INT) are personal

norms (1.544), perceived behavioral control (1.410), and past behavior (0.641). Evaluative attitude (EVA), affective attitude (AFF), and social support (SOC) have less importantly effect on intention to speed (INT). Descriptive norms (DES) and response to speed enforcement (ENF) are not significant factors influencing the intention to speed. Speeding behavior (BEH) is directly affected by past behavior (0.496) following by perceived behavioral control (0.428), and intention to speed (0.293).

Table 5. Direct effects in the hypothesized model and p-value

Factors	Impact on	Coefficient	Standard Error	Critical ratio	p-value
1. Personal norms (PER)	INT	1.544	0.864	1.787	*
2. Perceived behavioral control (PBC)	INT	1.410	0.494	2.853	***
3. Past behavior (PAS)	INT	0.641	0.110	5.817	***
4. Evaluative attitude (EVA)	INT	0.220	0.099	2.226	**
5. Affective attitude (AFF)	INT	0.198	0.097	2.035	**
6. Social support (SOC)	INT	0.144	0.073	1.967	**
7. Descriptive norms (DES)	INT	0.296	0.329	0.900	0.368
8. Response to speed enforcement (ENF)	INT	0.034	0.049	0.688	0.492
9. Past behavior (PAS)	BEH	0.496	0.091	5.433	***
10. Perceived behavioral control (PBC)	BEH	0.428	0.428	0.085	***
11. Intention (INT)	BEH	0.293	0.293	0.139	**

Note: *** significance at the 1% level. ** significance at the 5% level. * significance at the 10% level.

When considering the total effects of all factors on speeding behavior, most factors play significant role in the model and have indirect and/or direct impact on speeding behavior (Table 6). Speeding behavior appears to be mainly affected by perceived behavioral control (PBC) (total effects loadings of 0.841). PBC influences speeding behavior directly and indirectly, through intention to speed (INT). Past behavior (PAS) is the second most important predicting factor of speeding behavior (total effects loading of 0.683). The past behavior also has direct and indirect impacts on speeding behavior similar to perceived behavioral control factor. The third most significant factor of speeding behavior is personal norm, PER (0.452), followed by the intention to speed, INT (0.293). The personal norm affects speeding behavior indirectly through its influence on intention to speed. However, the affective attitude towards compliance with speed limit (AFF), evaluative attitude towards compliance with speed limit (EVA), and social support (SOC) have less substantial impacts on speeding behavior. Other factors that do not play any significant role in the model estimation are the response to speed enforcement (ENF) and descriptive norm (DES).

Table 6. Total effects of all factors on speeding behavior

Factors	Direct effects	Indirect effects	Total Effects
1. Perceived Behavioral Control (PBC)	0.428	0.413	0.841
2. Past Behavior (PAS)	0.496	0.188	0.683
3. Personal norms (PER)	0.000	0.452	0.452

4. Intention (INT)	0.293	0.000	0.293
5. Affective Attitude (AFF)	0.000	0.058	0.058
6. Evaluative Attitude (EVA)	0.000	0.064	0.064
7. Social Support (SOC)	0.000	0.042	0.042

4.3 Multiple group analysis

The multiple group analysis was performed to analyze the impact of each factor on different subgroups. In this study, four variables including university type, university location, household income, and driving experience were considered to evaluate the effects of each factor (Table 5). The analysis results from this section can be applied for the improvement of road safety campaign and the implementation of road safety policies.

Table 7. Direct effects on intention and speeding behavior for different groups

Factors	Impact on	University		Location of university		Household income		Driving Experience	
		Government	Private	Urban	Suburban	Medium	High	< 3 years	> 3 years
1. Personal norms (PER)	Intention	1.175	-0.458	2.702	0.859	3.143	0.692	1.325	-0.730
2. Perceived Behavioral Control (PBC)	Intention	0.869*	0.148	2.577	0.756*	2.259	1.141*	0.682*	0.424
3. Past Behavior (PAS)	Intention	0.650*	0.510*	0.717*	0.651*	0.845*	0.548*	0.627*	0.553*
4. Evaluative Attitude (EVA)	Intention	0.187*	-0.041	-0.005	0.154	0.309	0.145*	0.246	0.163*
5. Affective Attitude (AFF)	Intention	0.073	0.170*	0.351	0.110	0.482	0.088	0.256*	0.003
6. Social Support (SOC)	Intention	0.126*	-0.025	0.411	0.055	0.093	0.157*	0.095	0.024
7. Descriptive norms (DES)	Intention	0.411	-0.686	0.482	-0.011	0.408	-0.147	0.476	-0.614
8. The response to speed enforcement tools (ENF)	Intention	0.004	-0.070	0.121	0.019	0.117	-0.005	-0.079	0.013
9. Past Behavior (PAS)	Behavior	0.440*	0.742*	0.472*	0.725*	0.862*	0.260*	0.415*	0.557
10. Perceived behavioral Control (PBC)	Behavior	0.427*	0.525*	0.444*	0.472*	0.697*	0.187*	0.616*	0.568*
11. Intention (INT)	Behavior	0.340*	-0.055	0.371*	-0.128	-0.355	0.783*	0.332*	0.034*

Remark: * indicate a significant level of 0.01 – 0.10.

From Table 7, it is evident that perceived behavioral control (PBC), past behavior (PAS), and evaluative attitude towards compliance with speed limit (EVA) are significant factors influencing intention to speed of young drivers who are studying in the public university, while past behavior (PAS) and affective attitude towards compliance with speed limit (AFF) are significant factors influencing intention to speed of young drivers who are studying in the private university. For the university location, only past behavior (PAS) significantly influences intention to speed for those drivers who studying in the university located in the urban area, while perceived behavioral control (PBC) and past behavior (PAS) significantly influences the intention of those who studying in the university located in the suburban area. Similarly, these factors also influence young drivers with high household income. Perceived behavioral control (PBC), past behavior (PAS), and affective attitude towards compliance with speed limit (AFF) are significant factors influencing intention to speed of young drivers with less driving experience (less than 3 years), while past behavior (PAS) and evaluative attitude towards compliance with speed limit (EVA) have influence on intention to speed of young drivers who have more driving experience. Interestingly, it is clearly seen that past behavior (PAS) and perceived behavioral control (PBC) affect speeding behavior directly and indirectly through its influence on intention to speed (INT) in all different groups of samples.

5 Summary and Discussion

5.1 Influencing factors affecting speeding behavior of young drivers

The results of this study show the evidence that household income level, habits of watching auto racing movies, habits of seeing auto racing, and affective attitude towards speeding are statistically significant factors affecting speeding behavior of young drivers while driving on highways in urban/suburban areas and motorways. Young drivers with high income are more likely to drive with higher speed. This result supports many previous studies demonstrating that drivers with higher income are more likely to be speeding offenders, and tend to drive with higher speed than drivers with lower household income (Shinar et al., 2001; Karlaftis et al., 2003). Drivers were asked about their attitude towards compliance with speed limit by using the question of “driving close to or lower than 80 km/h (which is a speed limit) makes me nervous (affective attitude) and driving faster makes me safe more time (evaluative attitude)”. The analysis result shows that drivers who have negative affective attitude compliance with speed limit tend to drive faster. It is possible that the drivers within this group do not realize the posted speed limit or they may not accept the current setup of speed limit at which drivers normally think that it is too low. It is interesting to find that both habits of watching auto racing movies and seeing auto racing significantly affect speeding behavior. It is possible that these habits could change young driver behavior and support their attitude towards speeding. Drivers who usually drive with higher speed are reported that they have experience of receiving speeding ticket which is similar to the findings from previous research (Mannering, 2009). However, for this study, this analysis opposes the finding of previous research which argues that male drivers are more likely to speed when comparing to female drivers (Mannering, 2009; Beullens and Bulck, 2008; Braitman et al., 2008). It could be due to the difference of speeding behavior in different type of roads where the drivers are driving on. The finding of this study shows that female drivers tend to drive faster than males while driving within urban area, but slower than male drivers while driving in other areas. It should be noted that the control of self-report bias is a limitation of this

study since the speeding behavior of young drivers was not actually observed. However, several previous studies have found consistent relationships between self-report driving measures and behavioral measures, and the validity of self-report survey has been considered in the satisfied level.

5.2 Effect of existing TPB predictors on speeding behavior

According to the theory of planned behavior, speeding behavior can be predicted by attitude, subjective norms, and perceived behavioral control via intention, and also directly predicted by perceived behavioral control. Attitude towards behavior is distinguished to affective attitude and evaluative attitude in order to achieve best understanding (Ajzen, 1991). The findings of this study confirm the impact of both affective and evaluative attitude and perceived behavioral control on speeding behavior (Victor et al., 2005; Letirand and Delhomme, 2005; Warner and Aberg, 2006; Elliott et al., 2007; Warner and Aberg, 2008; Paris and Broucke, 2008; Elliott, 2010). Speeding behavior appears to be mainly affected by perceived behavioral control which both directly and indirectly predictor. This evidence confirms previous observation done by Poutter et al. (2008). Therefore, it can be stated that affective and evaluative attitude towards compliance with speed limit and perceived behavioral control are significant predictors of the intention to speed. However, this finding opposes to those results which are reported that subjective norms is significant determinants of speeding behavior. The path analysis of the hypothesized model in this study shows that subjective norms does not significantly influence speeding behavior of young drivers. In other words, family members and/or friends do not influence young drivers' speed selection. It is possible that young drivers normally select to speed based on their feeling and ability to control driving, not the influence from the behavior of their family and/or friends.

5.3 Effect of additional predictors on speeding behavior

Although the prediction of speeding behavior using the theory of planned behavior (TPB) has been successful in explaining speeding behavior, the TPB constructs have not been applied in the validity prediction for drivers' speeding behavior due to the lack of some explainable factors related to speeding behavior. The attitude, subjective norms and PBC have been proved that they are not enough to explain the speeding behavior. In recent years, many studies suggest some additional constructs to predict drivers' speeding behavior and their intention to speed. In this study, past behavior, personal norm, and descriptive norm are evaluated to confirm the finding of those recent studies. The hypothesized model in this study confirms the influence of personal norm and past behavior on speeding behavior of young drivers which support findings from previous studies (Elliott and Thomson, 2010; Pelsmacker and Jenssens, 2007). Past behavior can be used to predict both intention to speed and speeding behavior (Elliott and Thomson, 2010). Intention to speed is mainly affected by personal norms (Victor et al., 2005). Furthermore, personal norms is also affecting speeding behavior as the third important factors. However, the finding of this study opposes to the results of previous research (Elliott and Thomson, 2010; Forward, 2009) which reported that descriptive norms is significant predictor affecting intention to speed. According to the results of this study, descriptive norms is not significant in influencing the intention. It is possible that other drivers on the road can influence speeding behavior of young drivers in some situations. In other words, other drivers on the road (descriptive norms) cannot change the speeding behavior but it can influence the speed selection of young drivers.

For example, young drivers who are usually speeding may drive slowly because they follow the speed of vehicles in front.

In addition, this study aims to extend some explainable predictors related to speeding behavior into the TPB model. Two predictors were added based on their influencing factors related to speeding behavior: the response to speed enforcement and the social support. Social support has an influence on young drivers' speeding behavior. However, it is evident that the impact of social support is much less than other significant predictors. The response to speed enforcement does not influence either intention to speed or speeding behavior. It is surprising to see that the presence of speed enforcement has no influence on young drivers' speeding behavior. This could be possible because it is always observed in Thailand that most drivers usually reduce their speed when passing the speed enforcement zone, and then increase their speed after the speed enforcement zone.

6 REFERENCES

- Ajzen, I. (1991) The Theory of planned Behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211.
- Beullens, K. and Bulck, J.V. (2008) News, Music videos and action movie exposure and adolescents' intentions to take risk in traffic. *Accident Analysis and Prevention* 40, 349-356.
- Braitman, K.A., Kirley, B.B., McCartt, A.T., and Chaudhary, N.K. (2008) Crash of novice teenage drivers: Characteristics and contributing factors. *Journal of Safety Research* 39, 47-54.
- Clarke, D.D., Ward, P., Bartle, C., and Truman, W. (2010) Killer crashes: Fatal road traffic accidents in the UK. *Accident Analysis and Prevention* 42, 764-770.
- Department of Highways (2009) A survey of vehicle speeds on highways using automated traffic counters. Evaluation Group, Bureau of Planning, Department of Highways.
- Elliott, M.A., Armitage, C.J., and Baughan, C.J., 2007. Using the Theory of Planned Behavior to predict observed driving behavior. *British Journal of Social Psychology* 46, 69-90.
- Elliott, M.A. (2010) Predicting motorcyclists' intentions to speed: Effects of selected cognitions from the theory of planned behavior, self-identity and social identify. *Accident Analysis and Prevention* 42, 718-725.
- Elliott, M.A. and Thomson, J.A. (2010) The social cognitive determinants of offending drivers' speeding behavior. *Accident Analysis and Prevention* 42, 1595-1605.
- Fleiter, J.J., Lennon, A., and Watson, B. (2010) How do other people influence your driving speed? Exploring the 'who' and the 'how' of social influences on speeding from a quantitative perspective. *Transportation Research Part F* 13, 49-62.
- Forward, S.E. (2009) The Theory of Planned Behavior: The role of descriptive norms and past behavior in the prediction of drivers' intention to violate. *Transportation Research Part F* 12, 198-207.

- Hamilton, K. and White, K.M. (2008) Extending the theory of planned behavior: The Role of Self and Social Influence in Predicting Adolescent Regular Moderate-to-Vigorous Physical activity. *Journal of Sport & Psychology*, 30, 56-74.
- Hasselberg, M. and Laflamme, L. (2005) The social patterning of injury repetitions among young car driving in Sweden. *Accident Analysis and Prevention* 37, 163-168.
- Kanitpong, K., Jiwattanakulpaisarn, P., and Yaktawong, W. (2011) Speed Management Strategies and Drivers' Attitude in Thailand. *Presented to the 90th Transportation Research Board Annual Meeting*, Washington D.C.
- Karlaftis, M.G., Kotzampassakis, L. and Kanellaidis, G. (2003) An empirical investigation of European drivers' self-assessment. *Journal of Safety Research* 34, 207-213.
- Kulleab, S., Jirawak, S., and Kaewkanya, K. (2006) Model development for traffic injury prevention by speed control on Highway No. 2 in Khon Kaen province. Report No.147-2006-11, Khon Kaen Trauma and Critical Care Center, Khon Kaen Hospital, Thailand.
- Letirand, F. and Delhomme, P. (2005) Speed behavior as a choice between observing and exceeding the speed limit. *Transportation Research Part F* 8, 481-492.
- Mannering, F. (2009) An empirical analysis of driver perceptions of the relationship between speed limits and safety. *Transportation Research Part F* 12, 99-106.
- Paris, H. and Broucke, S.V. (2008) Measuring cognitive determinants of speeding: An application of the Theory of Planned Behavior. *Transportation Research Part F* 11, 168-180.
- Pelsmacker, P.D. and Jenssens, W. (2007) The effect of norms, attitude and habit on speeding behavior: Scale development and model building and estimation. *Accident Analysis and Prevention* 39, 6-15.
- Poulter, D.R., Chapman, P., Bibby, P.A., Clarke, D.D., and Crundall, D. (2008) An application of the theory of planned behavior to truck driving behavior and compliance with regulations. *Accident Analysis and Prevention* 40, 2058-2064.
- Shinar, D., Schechtman, E., Compton, R. (2001) Self-reports of safe driving behaviors in relationship to sex, age, education and income in the US adult driving population. *Accident Analysis and Prevention* 33, 111-116.
- Siwarochana, P., Morarit, S., and Chatraphibal, T. (2004) Risk behaviors of road users during New year festival in Thailand. Road Safety Report Card No. 2, Knowledge Management Unit for Road Safety, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok.
- Stradling, S., and Meadows, M. (2001) Young driver attitudes. UK: Department for Transport.
- Thailand Accident Research Center (2008) Safety driving speed. Report submitted to National Health Foundation.

Victor, A., Eertmans, A., Bergh O.V., and Brouck S.V. (2005) Learning to drive safety: Social-cognitive responses are predictive of performance rated by novice drivers and their instructors. *Transportation Research Part F* 8, 59-74.

Warner, H.W. and Aberg, L. (2006) Drivers' decision to speed: A study inspired by the theory of planned behavior. *Transportation Research Part F* 9, 427-433.

Warner, H.W. and Aberg, L. (2008) Drivers' belief about exceeding the speed limits. *Transportation Research Part F* 11, 376-389.