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Study on the Factors Influencing the Usage of Pedestrian Bridges

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Abstract
Road crashes, with the involvement of pedestrian is of great concern nowadays. One of the most vulnerable pedestrian group are those crossing the road below the pedestrian bridge. With the trend of crossing the road below the pedestrian bridges, pedestrian related crashes are increasing day by day. Hence, this research aims to identify the factors that influence the usage of the pedestrian bridge using questionnaire survey at ten pedestrian bridges locations of Kathmandu and Lalipur district. In total, 456 samples were collected of which 185 used pedestrian bridges for crossing the road whereas 271 cross the road without using it.Binary model was developed in order to identify the factors influencing use and non-use of pedestrian bridge. The model showed that use of the pedestrian bridge was significantly influenced by crossing time, crossing principles, baggage, previous crash experience, presence of bus stop and driving license

Keywords
Pedestrian bridges, Use and No Use, Logistic Regression

1. Introduction

Road traffic crash is of great concerning topic now a days. Over the period of 5 years,Traffic Police record data showed 27,150 crashes across the Kathmandu valley , out of which 624 people lost their lives and 1157 people were seriously injured.Of the deceased,296 were pedestrians.Pedestrians are the vulnerable road user groups and there are various causes of a pedestrian related casualties such as lack of pedestrian facilities, environmental conditions, and negligence of the pedestrians, geometric of the road. In order to reduce the number of such pedestrian-vehicle conflict various traffic facilities such as cross walks, sidewalks, pedestrian bridges, under pass are provided on the urban road. Though these facilities are provided for safe crossing of the pedestrian, pedestrian hesitate to use these facilities for crossing the road and rather choose to cross the road beneath the pedestrian bridge.

Pedestrian bridges are the structures provided over the road surface for the safe passage of the pedestrians. It eliminates the conflict of the pedestrian with the moving traffic. Provision of the pedestrian bridge also enhance smooth flow of the vehicle by elimination of the delay that can be caused by the pedestrian movement on the road surface.As the pedestrian bridges are built for crossing of the pedestrians, real scenario is quite different. Pedestrians, instead of using the bridge, cross the road from the level surface. Use of the pedestrian bridge generally involve increase in the walking distance, ascending and descending on the bridge, which increase in duration of crossings compared to the level crossings. Due to the above-mentioned reason pedestrian prefer the level crossings. However, with the adaptation of various measures, pedestrian traffic can be compelled to use the bridge. Police enforcement, use of the barrier between the sidewalk and the road edge, installation of the bar fence on the medians of the road, provision of the divisional islands are some of the measures that can be adopted to decrease the non-use of the pedestrian bridge.

The usage of the pedestrian bridge is influenced by the several individual characteristics of the pedestrians,geometric and traffic characteristics. Binary logistic regression was carried out to understand the various factors influencing the use and non-use of the pedestrian bridges. The usage of pedestrian bridge is taken as a dependent variable and is binary in nature as it involves use or not-use of the pedestrian bridge.

2. Literature Review

Hamed (2001)[1], investigated pedestrian crossing under the overpass and found that crossing by the pedestrian is the result of various significant factors. They consider traffic, environmental and individual characteristics, and among these factors, individual characteristics and pedestrian crossing facilities were the major contributing factors.[2]Moore(1953), investigated the use of crossing facilities in London. He studied the use of overpass and underpass,and found that only 80% of pedestrian would use overpass or underpasses for crossing of the road. He further found that, pedestrians will no longer use these facilities to cross the road used if the travel time is 1.5 times larger than that level crossings.[3] Sisiopiku(2003) observed the pedestrian selection behavior and perception towards different pedestrian facilities. His work was based on observation and safety data. Among the various factors, safety and convenience were the major factors for the use of crossing facilities.[4] Wuet.al.(2013), investigated the various factors contributing to the overpass selection using the questionnaire survey. Binary logistic regression analysis was performed in order to understand the factors influencing the use and non-use of the pedestrian bridges. Among the various variables considered, crossing time, detour distances, educational level, age, possession of the driving license had significant influence on no use of pedestrian bridge. The research further analyzed the odd ratios of the significant variables for the explanation of impact of the factors on the use and non-use of the pedestrian bridges.[5] Demiroz(2015), investigated pedestrian road crossing behavior without use of pedestrian bridge. He found that pedestrian crossing speed on road level dependent on vehicle speeds. He further stated that pedestrian chose to cross the road without the use of bridge if the vehicle is 50 m away from them.[6]Rasanen et.al.(2007) studied five pedestrian bridges in Turkey in Central Business District of Ankara. This study mainly focuses on finding the factors influencing the use and non-use of the pedestrian bridges. Familiarity of the site, Safety orientation, and convenience were considered as the independent variables. The results showed that use and non-use of the bridge was a habit rather than the coincidental behavior. This study further suggests that provision of the escalator on the pedestrian bridge improve the bridge performance whereas traffic signal under a bridge in negatively related with the bridge use rate.[7]Ramandani.et.al.(2018) studied pedestrian bridges crossing efficiency in road of Banjarmasin, Indonesia. Pedestrian surveys were conducted for the pedestrian crossings and highway crossings. The research work concluded that time saving was the most significant factors for the preference of the pedestrian to choose highway crossings. Other reasons for the selection of highway crossing were no maintenance and cleaning of the pedestrian bridges, presence of the beggars on the bridge. This research further suggests that fences are to be set on the medians to increase number of pedestrians using the bridge. and proper maintenance and cleaning of the bridge should be carried out.[8]Saadati et.al.(2019) studied factors influencing the use of the pedestrian bridges in Iran. Questionnaire survey was performed in order to collect the data on two types of the pedestrian bridges with and without the electrical stair. Bad appearance of the bridge, low lightness of the bridges were the barriers for non-use of the pedestrian bridge. This research further highlights that when the pedestrians are with a child, they tend to use the pedestrian bridges. Likewise, design of the pedestrian bridges with artistic principles facilitates the use rate of the pedestrian bridge.[9]Solorzano et.al. (2010), examined the intentions of the road users for using and not using of the pedestrian bridges in Mexico City. Cross Sectional survey was carried out for a sample of pedestrians in order to understand the reasons behind the use and non-use of the pedestrian bridges. Logistic regression analysis was performed to evaluate the motives for the use and no use of bridges. The results of the study showed that principal reason for the use of pedestrian bridge was safety whereas laziness was the principal reason for not using the pedestrian bridges. Furthermore, physical characteristics of the bridge was found to be significant for the non-use of the pedestrian bridges.[10]Sangphong et.al(2004), studied the footbridge utilization behavior in Nakhon Ratchasima. Data was collected by personal interview using questionnaires and pedestrian road crossing behavior. Logistic Regression analysis was carried out to understand the factors influencing the use of the footbridges in urban and sub urban areas. Number of pedestrians and the distance between the bus stop and the footbridge were the significant factors influencing use of the pedestrian bridges in urban areas whereas self-experience of the road accident, proximity to the bus stop, and knowledge on traffic rules and

regulations were the influencing factors for the use of the pedestrian bridges in sub urban areas. The study further suggests various measures such as properly locating footbridges near bus stops, public relation on pedestrian traffic laws to improve use rate of the pedestrian bridges.

3. Methodology

3.1 Study Area

The study area selected for the research is the Kathmandu and Lalitpur district. .Pedestrian bridges are constructed at major intersections of these two districts. . These pedestrian bridges are provided on the major roads and several pedestrian bridges are under construction on major intersection and highway section. Pedestrian bridges from Kathmandu, Lalitpur are selected for the study. Altogether, 10 pedestrian bridges are selected for the research purpose out of which three pedestrian bridges are in Lalitpur district and seven of them are in Kathmandu district. Lalitpur district pedestrian bridges are located on Ring Road area, whereas Kathmandu pedestrian bridges are located on the vicinity of the Ratnapark Area and Baneswor area.The detailed characteristics of the pedestrian bridges and road environment are summarized in the Table 1.

3.2 Questionnaire survey and Data measurement

Questionnaire survey was done for the collection of the pedestrian individual characteristics.Pedestrians were chosen randomly for the survey. Pedestrians were briefly explained about the objectives and purpose of the research work. After that, pedestrians individual characteristics which includes age, gender, marital status,frequency of the visit, license ownership, previous crash experience, crossing principles, possession of baggage was recorded on the questionnaire form. After the completion of the survey, participants crossing the road without the use of the bridge was given a present for the work. Crossing time was measured and recorded after the completion of the questionnaire survey. Characteristics of the bridge, road width below the bridge was measured and presence of bus stop with and without fence on the medians was observed after the completion of survey at each site.Table 2 presents the description of the variables considered in the research work.

3.3 Model Development

Use and non-use of the pedestrian bridge is the dependent variable in the analysis. The use of the PB (Pedestrian Bridge) is coded as 1, non-use of the PB is coded as 0. As the dependent variable, usage of pedestrian bridge is binary in nature, binary logistic regression is used in the analysis.There are 11 independent variables in the analysis. Among the 11 independent variables, 9 of them are categorical in nature and remaining 2 are continuous.Categorical variables are treated in different manner in comparison to the continuous variables. The two continuous variables crossing time and lane width are measured in seconds and meter respectively.Categorical variables are defined through dummy variables. For any n level of the nominal scale of the categorical variables there are (n-1) level of the dummy variables. Example for this coding is shown in Table 3.

Table 3: Coding of Categorical Variable

Frequency of Visit	D_1	D_2	D_3	D_4
Almost Never	1	0	0	0
Once in a month	0	1	0	0
Several times a month	0	0	1	0
Every day	0	0	0	0

The categorical variable ”Frequency of the area visit” has four categories namely ”Almost Never”, ”Once in a month”,”Several times a month” and ”Every day”. This categorical variable needs three dummy variables D_1,D_2,D_3.One variable is taken as the base variable and all the other remaining variables are calculated relative to these variables. For example, if the frequency of the area visit is ”Almost Never”, all the variables D_2, D_3, $D_4$are set to zero. If the frequency of the area visit is ”Once in a month” then D_1, D_3, D_4 are set to zero and D_2 is set to 1. If the frequency of the area visit is ”Several times a month” D_1, D_2 and D_4 are set to zero whereas D_3 is set to 1.Here the variable ”Every day” is taken as reference variable.

The widely used methods for the logistic model development are Forward Selection Process and Backward Selection Process. Forward Selection Process starts with void equation and the independent variables are added one by one and it picks those variables that predicts most on the dependent variable Backward Selection Process on the other hand starts with the full (saturated model) considering all the independent variables and eliminates those variables

Table 1: Pedestrian Bridge Characteritics

SN	Name of bridge	Length(m)	Width(m)	Height(m)	No of Stairways	Road Width
1	Koteswor PB	90	2.5	5	2	31.6
2	Gwarko PB	62	3	4.5	4	31.6
3	B and B PB	82	2.45	5	2	31.6
4	Baneswor PB	31	2.4	4.5	2	8
5	Bhadrakali PB	41	1.8	4.5	4	15
6	Bus Park PB	41	1.6	4.5	2	19
7	Bagbazar PB	70	2.5	4.5	8	15
8	Ratnapark PB	27	2.8	4.5	2	15
9	Bir Hospital PB	39	2	4.5	4	15
10	Sundhara PB	42	2.04	4.5	4	15

Table 2: Description of the variables

S.N.	Variables	Variable Type	Symbol	Variable description
1	Gender	Categorical	X_1	Male:1 Female:0
2	Age	Categorical	$X_{21}=1$ $X_{22}=2$ $X_{23}=3$	Young(<20):1 Middle aged(20-50):2 Elderly(>50):3
3	Frequency of visit	Categorical	$X_{31}=1$ $X_{32}=2$ $X_{33}=3$ $X_{34}=4$	Almost Never:1 Once in a month:2 Several times a month:3 Every day:4
4	Principles of crossing	Categorical	X_{41}=1 X_{42}=2 X_{43}=3	Safety:1 Convenience:2 Saving Time:3
5	Marital Status	Categorical	X_5	Yes:1 No:0
6	Baggage	Categorical	X_6	Yes:1 No:0
7	License Ownership	Categorical	X_7	Yes:1 No:0
8	Previous Crash	Categorical	X_8	Yes:1 No:0
9	Bus Stop without barrier on median	Categorical	X_9	Yes:1 No:0
10	Crossing time	Continuous	X_{10}	-
11	Road Width	Continuous	X_{11}	-

that are not significant at 95% significance level.In this study, backward Selection Process is used and the final model is as follows:

$$ln\frac{p}{1-p} = \beta_0 + \beta_1 * X_1 + \beta_2 * X_{2i} + \beta_3 * X_{3i} + \beta_4 * X_{4i} + \beta_5 * X_5 + \beta_6 * X_6 + \beta_7 * X_7 + \beta_8 * X_8 + \beta_9 * X_9 + \beta_{10} * X_{10} + \beta_{11} * X_{11} \quad (1)$$

p is the probability of using the pedestrian bridge,β_i is the constant of the independent variable X.The final model consist of the independent variables that are significant at 95% confidence interval.

4. Analysis of the Results

4.1 Preliminary Data Analysis

Total 691 questionnaire survey was done for model development and validation through interview at ten pedestrian bridges of Lalitpur and Kathmandu district for From the 456 responses,field observation and measurement following data were obtained.

4.1.1 Gender

Out of 456 respondents, 208 were female and 248 were male. Likewise, 113 males use the pedestrian bridges and 75 females make use of pedestrian bridges. The number of males not using the pedestrian bridge was 135 and female number for the same case was 133.

4.1.2 Age

Among 456 pedestrians, 101 pedestrians were below the age 20,252 pedestrians were between 20-50 years old and 103 pedestrians were above 50 years of age. Likewise, among the 271 number of pedestrians who didn't use the bridge,65 number of pedestrians were below 20 years old ,143 pedestrians were between 20-50 years and 63 pedestrians were above 50 years old. Among the 185 pedestrians who used the pedestrian bridges, 36 number of pedestrians were below 20 years old ,109 pedestrians were between 20-50 years and 40 pedestrians were above 50 years.

4.1.3 Marital Status

Among 456 pedestrians,243 of them were married and 213 were not married. Similarly, 108 pedestrians who were married used the pedestrian bridges and 135 pedestrians who were married didn't use the pedestrian bridge. The number of pedestrians who were not married and didn't use the pedestrian bridge was 136 and 77 pedestrians who were not married used the pedestrian bridge.

4.1.4 Principles of Crossings

Safety, Convenience and Saving in time were the crossing principles. Among, the pedestrian bridge users, 164 pedestrians used the bridge with safety as crossing principle and 47 pedestrians used the bridge with convenience as the crossing principle. Among the pedestrians who did not use the pedestrian bridges, 140 used the pedestrian bridge with convenience as the crossing principles and 131 number of pedestrians used the bridge with Saving in time as the crossing principle.

4.1.5 Driving License

Among 456 pedestrians,210 had the driving license whereas 246 were without the driving license. 150 pedestrians having the driving license use the pedestrian bridge and 60 of them didn't use the pedestrian bridges. Similarly, 83 number of pedestrians having no driving license use the pedestrian bridges and 163 number of pedestrians having no driving license didn't use the pedestrian bridges.

4.1.6 Previous Crash Experience

Among 456 pedestrians,115 had the previous crash experience whereas 341 had no previous crash experience. The number of pedestrians using the bridge with previous crash experience was 61 and 124 number of pedestrians without crash experience didn't use the bridge. Likewise, number of pedestrians with previous crash experience who didn't use the bridge was 54 and 217 number of pedestrians without previous crash experience didn't use the bridge.

4.1.7 Baggage

The number of pedestrians with and without baggage was 119 and 234 respectively. Out of 119 pedestrians with baggage, the number of pedestrians using and not using the bridge was 63 and 49 respectively. Likewise, out of 234 pedestrians without baggage, 122 used the bridge and 112 did not use the bridge.

4.1.8 Crossing Time

The crossing time for the pedestrians using the bridge and not using the bridge varied in accordance to the characteristics of the pedestrian bridges. The average crossing time for the pedestrian using the bridge was 85.2s and not using the pedestrian bridge was 40.9 s.

4.1.9 Bus Stop

Two of the pedestrian bridges have bus stop with barriers on the medians whereas remaining bridges have bus stop with no barrier on medians.

4.1.10 Road Width

The width of the road under the pedestrian bridges ranged from 7m in Baneswor road area to 30.8m in Ring Road.

4.2 Model Estimation

Correlation between road width and crossing time showed that these two continuous variables are highly correlated with each other.In order to avoid multicollinearity, road width was ignored in the analysis. The first run of analysis was done in SPSS (Statistical Packages for Social Sciences) for testing the significance of the independent variables at 95% confidence interval. Gender , marital status and age were found to be insignificant in the first run of analysis and the second run of analysis is carried out eliminating these insignificant variables.Frequency of area visit,baggage, previous crash experience,crossing time,license, bus stop and principles of crossings were found to be significant at 95% and can be seen in figure 1.

The second run of analysis was done with the remaining variables from first run of analysis and frequency of area visit was found to be insignificant at 95% confidence interval. Baggage, previous crash experience ,crossing time,bus stop,license and principles of crossing were found to be significant at 95%.The details of second run of analysis can be seen in figure2.

The third run of analysis was carried out with the variables that were significant in second run of analysis and in the third run of analysis crossing principles, baggage, previous crash experience,crossing time, bus stop and license were found to be significant at 95% confidence interval as can be seen in figure 3.

Thus from final and third run of analysis , final logistic model is in following form:

$$ln\frac{p}{1-p} = -0.964 - 2.413 * X_{42} - 4.972 * X_{43} - 0.941 * X_6 + 0.947 * X_7 + 0.877 * X_8 - 1.492 * X_9 + 0.042 * X_{10} \quad (2)$$

The value of p in the above equation gives the probability of using the pedestrian bridge.

4.3 Model Interpretation

As can be seen from equation 2, coefficients of the variables are positive and negative. The coefficient of the continuous variable "Crossing Time" is positive which implies that with the increase in value of the crossing time, increases the probability of using the bridge.Pedestrians having the sufficient crossing time is more likely to use the pedestrian bridge rather than crossing from the road level.The coefficient of the categorical variables license is positive, which means that probability of using the pedestrian bridge by the pedestrian having driving license is high in comparison to the pedestrians with no driving license. Similarly, the coefficient of the categorical variables previous crash experience is positive, which means that probability of using the pedestrian bridge by the pedestrian having previous crash experience is high in comparison to the pedestrians with no crash experience. The coefficient of the categorical variable bus stop is negative which means that pedestrians choose to cross the road from road level if there is presence of bus stop with no barrier on median.
The coefficient of the categorical variable baggage is negative which means that pedestrians with baggage with them are less likely to use the pedestrian bridge compared to the base variable with no baggage with them.Likewise, the coefficient of the categorical variables " Principles of Crossing " are negative which means that probability of using the pedestrian bridge compared to the base variable safety is low when the crossing principles are convenience and saving in time . Model can be further interpreted through odds and odd ratios. Odds ratios are the exponent of the coefficient of the independent variables. The exponent for the crossing time,previous crash experience and driving license are 1.043,2.404 and 2.577 respectively. Likewise, exponent of the variables baggage,bus stop and crossing principles are 0.390,0.225,0.090 and 0.007 respectively.

4.3.1 Effect of Crossing Principles

Crossing principle is the categorical variable and has three categories: safety, convenience and saving time. Safety is stated as the reference variable and remaining two variables convenience and saving in time are stated relative to this variable. Exponent of the coefficient for the variable convenience is 0.09, which means that odds of using the pedestrian bridge of the pedestrians with the convenience as the crossing principle is decreased by 91% than that with the crossing principle as safety for the given set of the independent variables. Similarly, exponent of the coefficient for the variable saving in time is 0.007, which means that odds of using the pedestrian bridge of the pedestrians with the saving in time as the crossing principle is decreased by 99.7% than that with the crossing principle as safety for the given set of the independent variables.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Time	.045	.006	50.157	1	.000	1.046
	Crash(1)	1.010	.351	8.283	1	.004	2.744
	Baggage (1)	-.947	.338	7.850	1	.005	.388
	Principles			49.133	2	.000	
	Principles (1)	-2.389	.393	37.013	1	.000	.092
	Principles (2)	-5.079	1.097	21.431	1	.000	.006
	Gender (1)	.488	.322	2.305	1	.129	1.629
	Age			.777	2	.678	
	Age (1)	-.200	.436	.210	1	.647	.819
	Age (2)	-.489	.563	.753	1	.385	.614
	Married (1)	-.123	.376	.107	1	.744	.884
	Frequency			5.727	3	.126	
	Frequency (1)	.812	.540	2.262	1	.133	2.252
	Frequency (2)	.322	.532	.365	1	.546	1.379
	Frequency (3)	.996	.461	4.678	1	.031	2.708
	BSTP (1)	-1.449	.372	15.186	1	.000	.235
	License (1)	.969	.389	6.199	1	.013	2.636
	Constant	-1.937	.705	7.546	1	.006	.144

a. Variable(s) entered on step 1: Time, Crash, Baggage, Principles, Gender, Age, Married, Frequency, BSTP, License.

Figure 1: Estimated model on first run of analysis

4.3.2 Effect of Baggage

Baggage is the categorical variable and has two categories, with and without baggage of the respondent. No baggage is used as a reference variable and possession of baggage is stated relative to this variable. The exponent of coefficient for the baggage is 0.39, which means that odds of using the pedestrian bridge with the baggage is decreased by 61% than that with no baggage for the given set of the independent variables.

4.3.3 Crossing Time

The exponent of the coefficient of the continuous variable crossing time is 1.043 which means that for a given set of the independent variables the ratio of odds of using the pedestrian bridge for a unit increase in the value of crossing time is 1.043. This means that for every unit increase in crossing time, the odds of using the pedestrian bridge increases by 4.3% for a given crossing principles, baggage, previous crash experience,driving license and bus stop.

4.3.4 License

License is the categorical variable and has two categories, with and without license of the respondent.No driving license is stated as a reference variable and possession of driving license is stated relative to this variable. Odds for the license is 2.577,

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Time	.043	.006	51.057	1	.000	1.044
	Crash (1)	.947	.346	7.487	1	.006	2.578
	Baggage (1)	-.994	.332	8.954	1	.003	.370
	Principles			52.364	2	.000	
	Principles (1)	-2.453	.384	40.903	1	.000	.086
	Principles (2)	-5.069	1.100	21.222	1	.000	.006
	Frequency			6.062	3	.109	
	Frequency (1)	.810	.533	2.306	1	.129	2.247
	Frequency (2)	.352	.525	.451	1	.502	1.423
	Frequency (3)	1.011	.448	5.093	1	.054	2.747
	BSTP (1)	-1.412	.367	14.800	1	.000	.244
	License (1)	.902	.373	5.863	1	.015	2.465
	Constant	-1.770	.638	7.699	1	.006	.170

a. Variable(s) entered on step 1: Time, Crash, Baggage, Principles, Frequency, BSTP, License.

Figure 2: Estimated model on second run of analysis

which means that odds of using the pedestrian bridge with the possession of driving license is 2.577 times more than that with no driving license for the given set of the independent variables.

4.3.5 Previous Crash Experience

Previous crash experience is the categorical variable and has two categories, previous crash experience and no previous crash experience of the respondent.No previous crash experience is used as a reference variable and previous crash experience is stated relative to this variable. Odds for the previous crash experience is 2.404, which means that odds of using the pedestrian bridge with the previous accident experience is 2.404 times than that with no previous crash experience for the given set of the independent variables.

4.3.6 Effect of Bus Stop

Bus stop is the categorical variable and has two categories, with and without barrier on the medians. Bus stop with barrier on medians is used as a reference variable and bus stop without barrier on medians is stated relative to this variable. The exponent of coefficient for the bus stop is 0.225, which means that odds of using the pedestrian bridge with bus stop with no barrier on medians is decreased by 77.5% than that with bus stop with barrier on medians for the given set of the independent variables.

4.4 Model Validation

The final model needs to be validated against the data that were not used to develop the model. Hence for the validation process, the data not used in model development were taken.Model is validated from the 235 samples not used in the model calibration.Validated model has the prediction ability of 82.1% as shown in Figure 4 below.

No use of the pedestrian bridge has the prediction accuracy of 85.9% and use of the pedestrian bridge has the prediction accuracy of 77.6%.Overall prediction accuracy of the model is 82.1% which means that 82.1% of the observed values and the predicted value on use and no use of the pedestrian bridges matches.Nagelkerke pseudo R^2 value is 0.660 which means the independent variables are

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Time	.042	.006	48.640	1	.000	1.043
	Crash (1)	.877	.342	6.591	1	.010	2.404
	Baggage (1)	-.941	.326	8.326	1	.004	.390
	Principles			52.358	2	.000	
	Principles (1)	-2.413	.379	40.635	1	.000	.090
	Principles (2)	-4.972	1.078	21.272	1	.000	.007
	BSTP (1)	-1.492	.361	17.043	1	.000	.225
	License (1)	.947	.364	6.752	1	.009	2.577
	Constant	-.964	.500	3.720	1	.054	.381

a. Variable(s) entered on step 1: Time, Crash, Baggage, Principles, BSTP, License.

Figure 3: Final estimated model from SPSS

Observed		Predicted		
		Use or non-use of pedestrian bridge		Percentage Correct
		No use of PB	Use of PB	
Use or non-use of pedestrian bridge	No use of PB	110	18	85.9
	Use of PB	24	83	77.6
Overall Percentage				82.1

Figure 4: Validation Table

contributing 66% to the model.

4.5 Remodeling using validation data

Model was first developed using 456 samples data and was validated using 235 data samples.Final model was developed using the data used for the model development and model validation which is shown in Figure 5.

Final equation was obtained as:

$$ln\frac{p}{1-p} = -1.349 - 2.499 * X_{42} - 4.433 * X_{43} - 0.966 * X_6 + 0.820 * X_7 + 0.789 * X_8 - 0.621 * X_9 + 0.046 * X_{10} \quad (3)$$

Nagelkerke pseudo R^2 value for the final model is 0.746 which means the independent variables are contributing 74.6% to the model.

5. Conclusions

The followings points can be concluded from the interpretation of the model:

i. Use of the pedestrian bridge is positively related with the categorical variables accident,crossing time and driving license. Likewise, it is negatively related to crossing principles,bus stop and baggage.

• The odds of using the pedestrian bridge with the previous crash experience is 2.404 times more than no previous crash experience.

• The odds of using the pedestrian bridge increases by 4.3% for every unit increase in the value of the crossing time.

• The odds of using the pedestrian bridge with

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Time	.046	.005	79.558	1	.000	1.047
	Crash (1)	.789	.301	6.852	1	.009	2.200
	Baggage (1)	-.966	.281	11.804	1	.001	.381
	Principles			86.252	2	.000	
	Principles (1)	-2.499	.306	66.572	1	.000	.082
	Principles (2)	-4.433	.766	33.478	1	.000	.012
	BSTP (1)	-.621	.292	4.526	1	.033	.538
	License (1)	.820	.315	6.765	1	.009	2.271
	Constant	-1.349	.435	9.625	1	.002	.260

a. Variable(s) entered on step 1: Time, Crash, Baggage, Principles, BSTP, License.

Figure 5: Final Model

possession of driving license is 2.577 times more than with no driving license.
ii. Use of the pedestrian bridge is negatively related with the categorical variable, possession of the baggage,principles of the crossings and bus stop.

• The odds of using the pedestrian bridge with possession of baggage is decreased by 61% in comparison to the pedestrians with baggage.
• The odds of using the pedestrian bridge with the convenience as the crossing principle decreases by 91% in comparison to the pedestrians with safety as the crossing principle. Likewise, odds of using the pedestrian bridge with saving in the crossing time as the crossing principle is decreased by 99.3%. in comparison to the respondents with safety as the crossing principles.
• The odds of using the pedestrian bridge with bus stop and no barrier on medians is 77.5% less than that with bus stop with barrier on medians for the given set of the independent variables.

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