

# Pickup Modifications for Rural Transport Services in Cambodia

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## Abstract

*This paper regards the operation of rural public transport services provided by pickup trucks and minibuses in Cambodia. Presented are survey data revealing how pickup modifications, especially cargo area canopies, are used to increase passenger and cargo capacity. A particular emphasis is placed on the importance of pickup transport services to economic activity. The results reveal that passengers traveling for economic reasons constitute 66 percent of passengers and carry 77 percent of the cargo weight. Transport operators may be modifying vehicles in response to their passengers' commercial requirements. This paper highlights both the economic benefits and safety risks of such modifications.*

## Introduction

There is a lack of rural transport services in much of the developing world and, where roads are poor, pickups are a preferred mode of transport, which is vital to economic development. Consequently, pickups are often fitted with benches and roof racks, enabling them to comfortably carry a dozen or more passengers on trips of up to 200km (Starkey et al. 2002).

Cambodia's pickups carry 13 percent more passengers and 5 times the cargo weight of minivans (Rozemuller, Thou and Yan 2002). However, pickups are more susceptible to rollover because of their high center of gravity. The risk of rollover is heightened when goods are loaded on roof racks, as the center of gravity is raised

even higher. Each additional passenger in the cargo area also raises the pickup's center of gravity, while their unrestrained weight movement further increases vehicle instability (Anderson et al. 2000). Banning overloaded vehicles, however, is unlikely to be successful in developing countries. Supply limitations mean commuters have few other options, and curtailing their travel would have severe social and economic consequences; transport services have been shown to be vital to economic development and poverty reduction in rural areas (Starkey et al. 2002; Nelson and Strueber 1991).



**Figure 1. Pickup Taxi Fitted with Canopy  
Boarding the Preaek Ta Meak Ferry**

As the main risk of injury in pickup trucks is from falls and ejections (CIPP 2000), a canopy attached to the pickup offers some protection for passengers. Canopies have proven effective in Australia's aboriginal communities (Macaulay et al. 2003; Hawkes 2005). The conditions in these communities are likened to those in third-world countries (Young 1995). These conditions include poor roads, an under-supply of vehicles, a predominance of old and poorly-maintained vehicles, and poor driver training (NTRS 2006).

Cambodia is a low-income country with a gross national income of US\$1820 per capita at purchasing power parity, and 80 percent of its 14.7 million people live in

rural areas (World Bank 2009). Rural roads are in a poor state, and there are few motorized vehicles (0.8 four-wheelers per 100 people). Cambodia’s fleet of transport providers is “fragmented,” and most vehicles are aged and overloaded (World Bank 2007).

Pickup trucks operate as taxis throughout rural Cambodia. The pickup taxis follow regular bus-like routes but pick up and put down passengers where requested. The principal alternatives to pickup and minibus taxis are large air-conditioned coaches. Coaches are essentially luxury transport with a fixed price (e.g., US\$2.50 between Phnom Penh and Kampong Cham). In comparison, a pickup or minibus taxi costs around \$1.25. However, prices for taxis are negotiable, and greater discounts are available to passengers willing to ride on the roof or bonnet.

Accidents and injuries involving—though not necessarily resulting from—overloaded taxis are frequently reported in Cambodia’s popular media. There is, for instance, the case of a passenger who was killed when her pickup lost control and overturned (Koh Santepheap 2006b). Similar cases of fatal accidents involving vulnerable minibus passengers are reported, including roof-riding passengers (Koh Santepheap 2006a). There are also events involving multiple casualties, including one involving more than 30 casualties (HIB 2007) and another involving 23 (AFP 2008).



Figure 2. Sign Denoting Wrong Way/Correct Way (Neak Chea, 2006, used with permission)

## **Modifications to Pickups**

A taxi operator typically invests US\$5,000-\$7,000 in a pickup and modifications. There are six common modifications made to increase a pickup's carrying capacity:

- Bars for longitudinal chassis reinforcement are welded to the vehicle's underside.
- Additional leaf-springs are installed to reinforce the rear suspension.
- Firestone CV9000 heavy duty tires are fitted.
- A rope or chain is used to increase the tailgate's load capacity.
- Removable tailgate seats are fitted.
- A locally-manufactured canopy is used to increase load capacity and protect passengers.



**Figure 3. Common Canopy Design**

Canopies are fitted to the pickup's cargo area. The canopy increases load capacity while offering passengers some protection from the elements as well as increased safety. The canopy costs around US\$450 fitted.



**Figure 4. Removable Seats Attach to the Tailgate**

These seats accommodate four additional passengers but are nominally prohibited. There is no discernible media support for the ban (see Figure 2), and passengers pay the same price for a fixed or removable seat. There are no known incidents of passengers falling from removable seats.

## **Research Method**

These data emerged incidentally from a safety review of canopy use in Cambodia. A survey was undertaken of 100 adult passengers at three Kandal province ferry crossings (see Figure 5) located 25km north northeast of Phnom Penh at Preaek Ta Meak (N=42), Svay Ath (N=17) and Ruessei Chrouy (N=41). Passengers were traveling routes along National Highway 6A between Phnom Penh and the eastern provinces of Kampong Cham, Prey Veng, and Svay Rieng. The sample distribution at each site was a proportional random selection of daily traffic estimated by ferry staff. The sample group for the structured-interview questionnaires was selected on the basis of convenience, as taxis were required to stop at the Kandal ferry terminals. The respondent selection was randomized by selecting the adult passenger seated in the middle of the row closest to the interviewer's approach. The passen-

ger survey included 100 adult taxi passengers of both pickups and minibuses, as the services may be substitutable.



Figure 5. Phnom Penh (A) and Ferry Locations (B, C & D)<sup>1</sup>

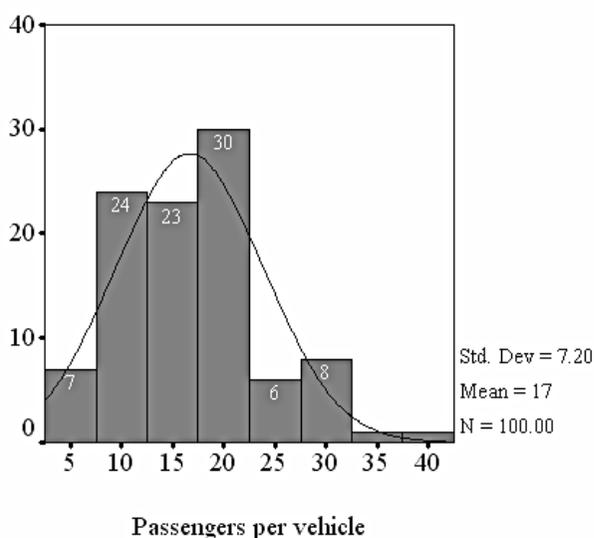
## Survey Results

An overview of findings is presented in Table 1. There was an inverse Pearson correlation between cargo loads and passenger numbers ( $-0.214$ ,  $\text{sig} < 0.05$ ). There was a positive correlation between passengers' reason for travel and their accompanied cargo weight ( $0.203$ ,  $\text{sig} < 0.05$ ). There was an inverse correlation between gender ( $1 = \text{female}$ ) and accompanied children ( $-0.237$ ,  $\text{sig} < 0.05$ ). The most significant correlation was between reason for travel and the frequency of journeys per month ( $0.447$ ,  $\text{sig} < 0.01$ ).

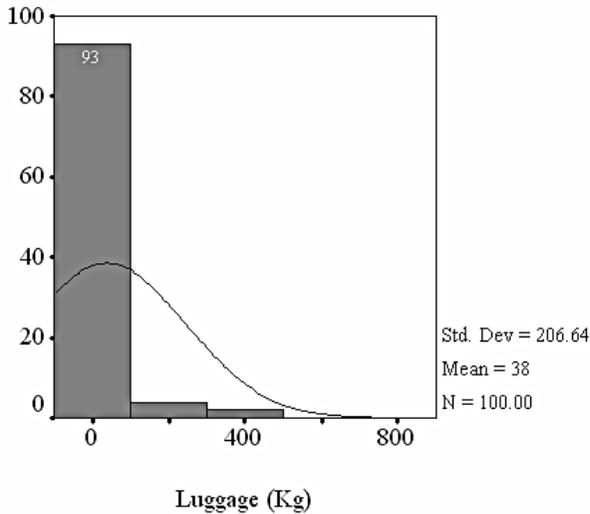
The passengers and cargo distributions are illustrated in Figure 6 and 7, respectively. While 93 percent of passengers carry less than 100kg in accompanied luggage, one passenger was carrying 2,000kg in luggage. The average taxi was carrying 1,878kg in the cargo area including passengers (1,252kg) and luggage (635kg). These calculations were made assuming that each adult passenger weighed an average of 65kg and each child weighed 25kg; passenger and cargo weights were calculated using the average numbers of passengers and accompanied children (16.7 and 0.16, respectively) and 38kg of accompanied luggage per adult passenger.

**Table 1. Descriptive Statistics (N=100)**

	Min	Max	Mean	Std. Deviation	Std. Error
Vehicle	0=Minibus	1=Pickup	0.91	0.29	0.03
Passengers	3	40	16.65	7.20	0.72
Luggage (kg)	0	2000	38.03	206.64	20.66
Age	18	67	35.65	12.62	1.26
Gender	0=Male	1=Female	0.53	0.50	0.05
Reason for travel	0	3	1.70	1.00	0.10
Journeys/month	1	60	8.09	12.70	1.27
# accompanied children	0	2	0.16	0.47	0.05



**Figure 6. Distribution of Passengers per Vehicle**



**Figure 7. Distribution of Cargo per Vehicle**

Each passenger’s reason for travel was classified into one of four categories: *economic*, such as “to sell things at market”; *health*, such as “coming back from the hospital”; *social*, such as traveling “to the pagoda to perform a ritual”; and *not classified*, where the response was, in every case, “returning home” (see Table 2). The 30 economic travelers were actively engaged in commercial activities such as capital acquisitions (“to buy fishery equipment”) and wholesale trade (“to buy thing for selling at the market” or “taking things to sell at market”). Some travel reasons were marginally economic but have been assigned to one of the other categories. For instance, passengers traveling “to buy medicines for personal use” have been classified as *health*. Table 2 includes the frequency of travel by tertiles of journeys per month. The most frequent third of travelers took more than five journeys per month, while the least frequent travelers averaged fewer than three.

While 42 percent of passengers were traveling for social reasons, they represent only 20 percent of the market, as they make fewer journeys (Table 3). The higher journey frequency of economic travelers means they represent 66 percent of the market. Comparing reason for travel with respondent luggage weight, economic travelers’ luggage is 2.5 times the average weight. This is important: economic travelers represent 66 percent of journeys and carry 77 percent of the luggage weight. They are the most important part of the market, and 97 percent of these passengers prefer to travel by pickup rather than minibus.

**Table 2. Passenger Numbers and Luggage Weight by Frequency of Journeys per Month and Reason for Travel**

		N	Mean	
			Passengers	Luggage (Kg)
Reason for travel	Social	42	17.21	8.67
	Not classified	19	16.58	26.21
	Economic	30	16.10	98.00
	Health	9	16.00	0.11
Tertiles of journeys/month	Most (>5)	36	16.61	85.69
	Mid (4-5)	19	17.32	16.32
	Least (<3)	45	16.40	9.07

**Table 3. Luggage Weights and Monthly Travel Frequency by Reason for Travel**

Reason for Travel	N	Travel Frequency (per month)			Luggage weight (kg)		
		Mean	Sum	% of Sum	Mean	Sum	% of Sum
Social	42	4	167	20.6	8.7	364	9.6
Economic	30	17.9	537	66.4	98.0	2940	77.3
Health	9	2.8	25	3.1	0.1	1	0.0
Not classified	19	4.2	80	9.9	26.2	498	13.1
<b>Total</b>	<b>100</b>	<b>8</b>	<b>809</b>	<b>100</b>	<b>38</b>	<b>3,803</b>	<b>100.0</b>

## Conclusion

This research provides further evidence of the important role pickup trucks play in facilitating transport and economic activity in rural areas. Most notably, passengers traveling for economic reasons constitute 66 percent of the market and accompany 77 percent of the cargo load. More importantly, this paper documents the technical modifications made to pickups so they can carry additional passengers and cargo. Rural public transport in Cambodia is benefiting from a capacity improvement by using cargo canopies and removable tailgate seats on pickup trucks. These modifications enable taxis to transport an average of 17 passengers plus a 635kg cargo load.

Given the important results, further research is required. A study with a larger sample should be undertaken and should be designed with the express objective

of identifying trends in cargo and passenger transport with and without cargo canopies and by various vehicle types. A longitudinal study that examines changes over time and includes vehicle weights would yield data better able to inform transport policy makers. Comparative research in other jurisdictions also needs to be undertaken.

This paper also raises important safety implications for policy makers. By increasing the load capacity of the pickup at a higher center of gravity, the canopy and vehicle modifications reduce the stability and handling of the vehicle. To what extent this detracts from the canopy's protection of cargo-space occupants is very important, but unknown. Consequently, a high priority for further research is the real-world crash effectiveness of the canopy; more needs to be known about passenger injuries and the circumstances in which the most serious occur. Even with a canopy, injuries resulting from shifting cargo (Williams and Goins 1981), impact with the interior of the cargo area (Anderson et al. 2000), or the canopy becoming detached (Children's Safety Network 2005) could be expected. Ultimately, as Agran et al. (1994) warned, "there is no safe, crash-tested means of travel in the cargo areas of pickup trucks."

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## **Endnotes**

<sup>1</sup> The ferries are situated at +11° 44' 40.49", +104° 59' 29.04" (N 11.74458 E 104.99140), 23.1 km NxNE of Phnom Penh; +11° 45' 10.91", +105° 0' 3.13" (N 11.75303 E 105.00087), 24.4 km NxNE of Phnom Penh; and +11° 46' 58.33", +105° 0' 44.75" (N 11.78287 E 105.01243), 27.9 km NxNE of Phnom Penh. A satellite map has been prepared at <http://mapper.acme.com/?ll=11.69460,104.96784&z=11&t=H&marker0=11.55000%2C104.91669%2CPhnom%20Penh&marker1=11.75303%2C105.00087>

24.4% of 20km x NE of Phnom Penh & marker2=11.78287% of 105.01243% of 27.9% of 20km x NE of Phnom Penh & marker3=11.74458% of 104.99140% of 23.1% of 20km x NE of Phnom Penh

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