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RURAL INLAND WATER TRANSPORT

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May Chreiy Village, Puok District, Siem Reap Province, Cambodia

By

Damien Vella

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EXECUTIVE SUMMARY

The aim of this study was to quantify the role of water transport in facilitating mobility and access to essential goods and services. This information can then be used to identify priorities for improving the water transport system and ensuring its long-term future.

The village of May Chreiy is located in Puok District, Siem Reap Province. The villagers live in floating timber houses on the edge of the Tonle Sap and relocate as the water level changes. Fishing is the main source of village income. Villagers rely on water travel and transport throughout the year. During the dry season, villagers use a series of canals that link villages together. During the wet season, the area is flooded and travel routes are more loosely structured.

A series of surveys were conducted to investigate water travel in May Chreiy. The first was a traffic count conducted at two locations either side of the village to measure the daily volume of water traffic. The second was an Origin and Destination survey to gather detailed information about journey type and vessel load. A household survey was conducted to investigate household travel and transport. Household wealth ranking was used to compare travel times, transport type and accessibility with wealth. Finally, an Integrated Rural Accessibility Planning workshop was held with villagers to identify priorities for infrastructure investment.

The most common vessel observed was the locally made canoe propelled by paddle. Boats propelled by oar had the highest average travel time with little variation between the propulsion categories of paddle/stick, hand, engine and tug. The type of vessel varied depending on its use or the type of goods it transported. Motorised boats carry 51 percent of all transport weight.

Traffic flow is less on the weekends than weekdays. There is some evidence to suggest adverse weather conditions influence the amount of water traffic. Waterways are busiest in the morning hours, 52 percent of daily traffic was recorded before 11a.m.

Men make 79 percent of water travel between villages. Women were observed travelling more frequently by boat within the village. This suggests that women tend to remain in the village close to the family home while men leave the village to work. Ninety four percent of motorised vessel drivers are men; women are more likely to use non-motorised vessels. Taking retail goods to market was the transport activity with the highest proportion of female participants (35%). While the male/female participation rates for many activities were relatively similar, fetching firewood and fishing were activities mostly carried out by men. Men travel on average 14.5 kilometres a day compared to 5.5 kilometres for women. The average household spends five hours per day travelling on the waterways.

Wealthier families spent most of their time at the market or selling fish while the poorest families spent most of their time fishing or collecting firewood. Wealthy families also spent more time travelling per day. The average age of vessel drivers was 29 and average travel time was found to increase with age.

Around half of the vessels surveyed were empty which may indicate inefficient use of water transport. Of the remainder, around half carried passengers and half carried commodities.

Seafood accounted for almost 40 percent of all goods carried. Seafood is mainly exported to other locations while fresh vegetables, fruit, firewood and ice were most likely to be brought in from villages closer to roads and markets. Around half of the vessels bound for May Chreiy were carrying passengers. Most boats in May Chreiy are privately owned, (88.4%) despite appearances suggesting May Chreiy is a poor village.

Average travel times for various activities are longer in the dry season and there is only a small difference in trip numbers between the seasons. More effort is expended transporting goods in the dry season. Water is collected directly from the Tonle Sap expending very little transport effort during the wet season however villagers have to travel to less polluted areas of the lake to collect drinking water during the dry season.

The surveys culminated in an investigation of village accessibility through the ILO's Integrated Rural Accessibility Planning tool. This rated village access to essential goods and services and ease of transport and travel. Accessibility results for May Chreiy were then compared to other villages in Puok District. May Chreiy was found to have the worst access to clean drinking water of any village in the district. Access to markets, transport infrastructure and health care were comparatively poor, while access to primary education was good compared to other villages. Priority areas for improvement were access to clean drinking water and improved access to health care and markets. To this end, the study recommends the drilling of two wells and the rehabilitation of a canal/roadway that would improve access to an all weather road, thus improving accessibility to other goods and services.

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INTRODUCTION

Inland water transport plays an important role in Cambodia by providing access to basic social and economic needs and services. Accessibility has traditionally been measured by proximity, ease of travel and travel costs using roads, paths and tracks. This study is the first in a series of ILO studies investigating the role of inland water transport in providing mobility and accessibility to needs and services.

Accessibility is defined as the ability to reach, use or visit. Accessibility is provided by transportation, transport infrastructure or by the service or need being located near the population. When examining water transport, vessels are the means of transport and transport infrastructure encompasses waterway planning, development, maintenance and docking facilities that enable the transfer from one mode of transport to another.

Cambodia's two main topographical features are the Mekong River and the Tonle Sap Lake. The Mekong begins in Tibet and flows through Cambodia to the South China Sea via southern Vietnam. The Tonle Sap Lake is linked to the Mekong at Phnom Penh. From mid-May to early October, the level of the Mekong rises, backing up the Tonle Sap River and causing it to flow into the Tonle Sap Lake. During this time, the surface of the lake swells to two and a half times its area and the maximum depth increases from around two metres to over ten metres. As water levels in the Mekong fall during the dry season, the Tonle Sap River reverses its flow back into the Mekong and drains the Tonle Sap Lake. Appendix B shows a map of Cambodia and Siem Reap province where the study was located.

Surrounding the Tonle Sap are villages that have adapted their accommodation and way of life to the movements of the lake. It has not been scientifically established how these villages handle water level fluctuations, or how much villagers rely on water transport to meet their accessibility needs.

The location of this case study is the village of May Chreiy, Kaev Poar Commune, Siem Reap Province (see map of study area, Appendix C). May Chreiy was selected because of its reliance on water transport and the interaction of villagers with the nearby rural road network and marketplace. The study took place over several months during the wet season, 2000.

The villagers of May Chreiy and others that border the Tonle Sap, live life on the move. During the dry season, the village is located on the edge of the Tonle Sap, with the population living in small floating timber houses built on bundles of bamboo. The life span of these buildings is estimated to be four to five years. This, along with the cost of construction, results in houses of low strength and durability. During the wet season, the Tonle Sap swells, flooding the villages. The village is also subjected to high winds and heavy storms. Because of these adverse weather conditions, many of the floating houses are forced to relocate, or risk being destroyed by the weather.

The villagers of May Chreiy derive most of their income from fishing the Tonle Sap. As villagers rely on fishing and need to be close to the fishing grounds, the floating village has evolved allowing it to move with the seasons. There are many villages near May Chreiy with similar conditions. A more complete picture of the characteristics of inland water transport in rural Cambodia could be established by including these villages in future case studies.

Integrated Rural Accessibility Planning (IRAP) is a local planning tool used by the ILO. IRAP approaches infrastructure planning through accessibility. IRAP uses participatory methods to identify local priorities for investment and can be used to compare accessibility with other villages in the district. IRAP has traditionally focussed on land travel - water transport has not been a part of the IRAP planning process. Investigating the characteristics of inland water travel and transport in May Chreiy can help to refine the IRAP procedure making it an effective tool to evaluate accessibility in all villages.

To this end, the study aimed to obtain a quantitative measure of the role and characteristics of water transport in providing accessibility. A series of surveys were conducted - a traffic count was made to determine the volume of traffic through the village of May Chreiy. An Origin and Destination (O&D) survey was then conducted to obtain a better understanding of whom, where, what, why, how and for how long people travel using the waterways surrounding May Chreiy. To get a more detailed understanding of what motivates the villagers to use the waterways and how they are used to meet daily needs, a household survey was conducted. Wealth ranking was also carried out to compare wealth with transport means, travel times and accessibility. Finally an IRAP workshop was carried out in May Chreiy to determine access to needs and services and to discover village priorities for infrastructure investments.

METHODOLOGY

This is the first study of Cambodian inland water transport on a rural level. A quantitative measure of users and their vessels is necessary to understand the role of water transport in meeting the mobility needs of the rural population. To achieve this, a series of surveys, interviews and workshops were conducted. The information collected was analysed and compared to secondary data to determine a profile of the vessel types, traffic characteristics, gender and age comparisons, load characteristics and ownership trends.

Traffic Count

A traffic count was made to discover the total volume of traffic flowing through the floating village of May Chreiy. The count was taken at two locations, 100 metres north and 100 metres south of the May Chreiy pagoda, along the water channel leading from the Tonle Sap to the village of Chong Teuk. A schematic layout of the village can be seen below:

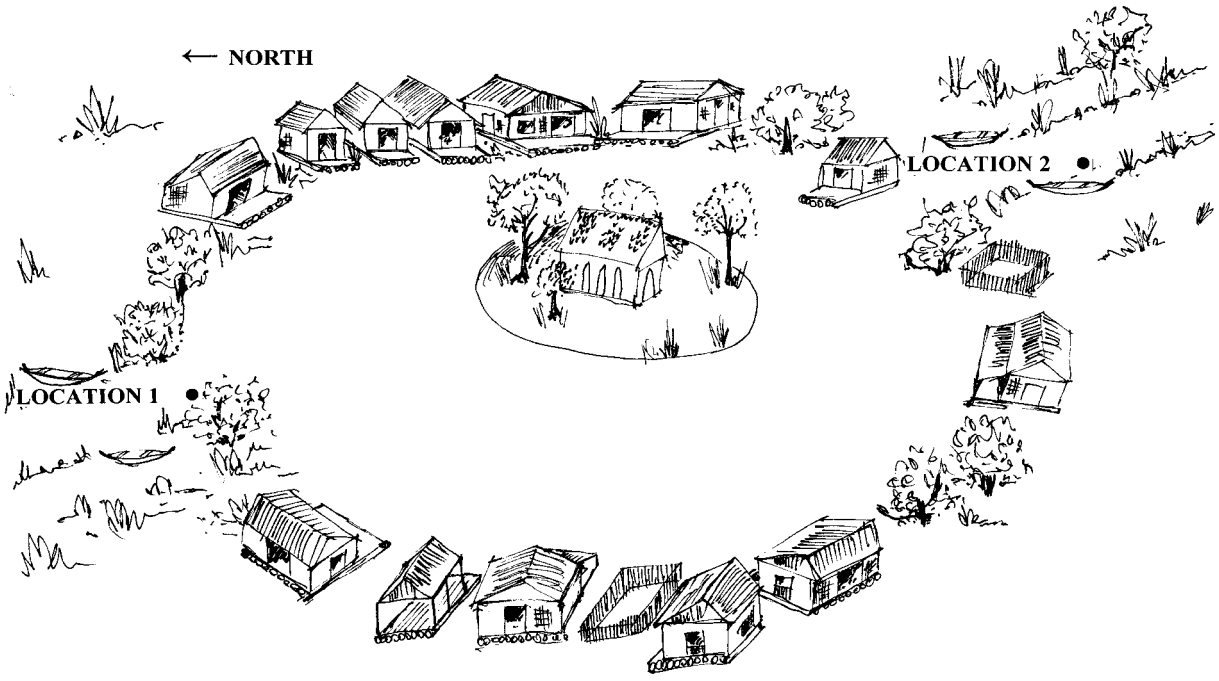


Diagram 1: Layout of May Chreiy Village

A pilot survey was conducted to determine the types of vessels using the waterway. Traffic was then categorised into eight vessel types (see diagrams appendix A):

No.	VESSEL TYPE
1	Canoe Propelled by Paddle
2	Canoe Propelled by Oar
3	Non-Motorised Longboat
4	Motorised Canoe
5	Motorised Longboat
6	Barge
7	Small Speedboat
8	Large Speedboat

Table 1: Categorisation of Vessel Types

The villages of Chong Teuk, Ang, May Chreiy and Peam Ta Uor are linked by canals (see appendix C). These canals are constructed when the water recedes during the dry season. Construction is simple; the canal is excavated and the excavated material is placed on either side to form the canal walls. These walls are compacted and constructed to a width sufficient for use as a roadway during the dry season and the initial months of the wet season. These canals have gradually silted up and are now overgrown with weeds and trees, therefore they are not navigable during the dry season or wet/dry transition. In the wet season, the water depth is sufficient for boats to travel over natural flood plains. During this time of year, people do not follow structured routes between villages. As the water recedes, villagers resort to the canals and longer routes via the Tonle Sap Lake.

The traffic count was conducted over seven days from the 18th to the 24th of August, 2000. It began at 6 a.m. and continued until 6 p.m. Over the seven day survey, 3005 vessels passed the two traffic count locations. Of these, 1527 travelled into the village and 1478 travelled out. According to these proportions and the trends in inward and outward flow, it is reckoned that the vast majority of traffic flowed through the village during these hours. It is possible that some traffic was not recorded by the traffic counters due to the nature of water transport and the tendency for vessels to use different routes.

Origin and Destination Survey

The O&D survey aimed to obtain a detailed profile of waterway users, the vessels and the role inland water transport plays in and around May Chreiy village. The O&D survey was conducted at the same time and at the same locations as the traffic count. One interviewer targeted inward traffic and one targeted outward traffic. Interviewers surveyed 2300 vessel users or 76 percent of the total vessels that passed the traffic count locations. Vessels were stopped for less than a minute, to avoid interfering with the natural traffic flow. Drivers were asked a series of questions relating to the vessel, driver, journey and loading.

To obtain a more complete understanding of the different hull types and means of propulsion, detailed categories were devised. Inconsistencies were found in the vessel type classification when the results of the traffic count were compared to the O&D survey. The data used in the O&D survey was therefore regrouped to encompass broader categories and ensure reliability and consistency.

Household Survey

The household survey was used to obtain detailed information on household needs and how water transport is used to meet those needs. Sixty eight structured interviews were collected,

representing 30 percent of the total households in May Chreiy. Data on the weight transported, distance travelled and trip frequency were collected and used to confirm the other survey findings. The survey was conducted over five days, from the 25th to the 29th of October, 2000. Each interview took approximately three hours to complete and was conducted in Khmer by two interviewers.

The survey began with general household information i.e. number of people in the household, age, sex, main source of income and means of transport. A daily itinerary was completed, describing, hour by hour, the daily activities undertaken by the household. A separate schedule was completed for the wet and dry seasons. A structured interview was then conducted. This interview gathered information on time, distance, route, method and costs of carrying out a series of activities, in both wet and dry seasons.
The following activities were included:

- Water collection
- Collecting firewood
- Fishing
- Rice cultivation
- Growing vegetables
- Growing fruit
- Raising animals
- Non-agricultural activities
- Market visits
- School attendance
- Visiting health facilities
- Pagoda visits
- Social visits

Wealth Ranking
Wealth ranking is the relative ranking of all households according to reported wealth. Wealth ranking provides supplementary information, which can be combined with the results of a household survey, to allow the comparison of wealth to travel time, travel mode and travel patterns. Using this method, we can draw comparisons between relative wealth and accessibility.

Wealth ranking generates a profile of living standards as perceived by the people. The wealth ranking was carried out by the following group of key informants:

- The Village Chief
- A representative from the Women's Committee
- Three elderly men
- A Monk's representative
- A representative from the Village Development Committee

These informants had a list of all households in the village. Informants decided how many categories they would use in the ranking and what those categories would represent. Following the ranking exercise, three categories were used for village households: medium (6%), poor (42%) and poorest of the poor (52%).

Informants defined 'medium' families as having adequate food all year, equipment for fishing and possessing enclosures for breeding and raising fish. Medium households can also visit trained doctors, have a radio or television and live in a solid house with an iron roof. These households have a motorised boat and at least two non-motorised vessels.

Poor families live in small cottages with bamboo walls and a leaf roof. They have an adequate supply of rice but a shortage of meat or vegetables for some of the year and may need to borrow money. They have a small non-motorised boat and equipment for fishing. Some poor households have a radio.

The poorest of the poor have rice shortages for some of the year and live in very small bamboo huts. These households do not have a vessel or equipment for fishing and rely on wage labour to earn a living.

IRAP Workshop

The final step was to investigate and quantify accessibility in May Chreiy. The IRAP workshop was carried out with a group of eight village representatives. The village representatives consisted of six villagers, the deputy Village Chief and a representative from the Monk's committee. The workshop took place on the 24th of October, 2000.

To assess the current accessibility situation using IRAP, information was collected on travel time, mode, cost and travel frequency to various needs and services. Indicators were then assigned to the responses allowing calculation of a priority ranking for the village and its relative accessibility within the district. Village representatives were asked to prioritise access improvements to drinking water, firewood, health services, the district centre, markets, education, employment, public transport services and infrastructure. The overall village priority indicator was derived from the calculated priority value and the villagers' perceived priorities.

Workshop responses were for an average villager at the time of year when accessibility is most difficult. Facilitators used large sheets of paper to collect the information and ensure the participation of each representative. Participants were encouraged to question their colleagues' responses to promote discussion, thereby obtaining the most representative and reliable information.

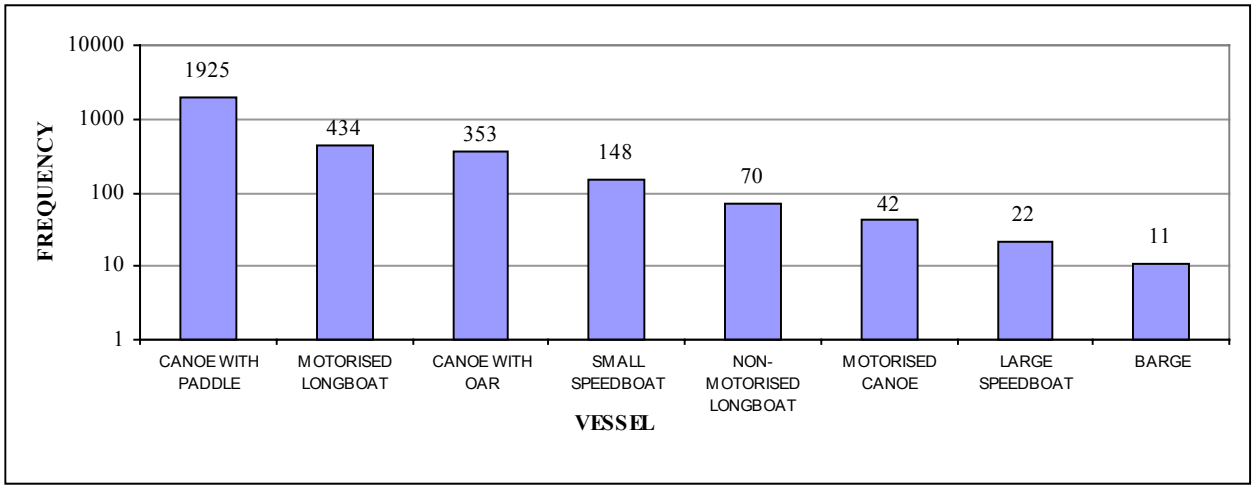
After gathering information on time, mode, cost and frequency, participants were asked to draw a map of the village area and identify routes used to collect drinking water, firewood, visit health centres, the district centre, markets and to attend school.

The final workshop component focussed on employment opportunities within the village. Together the representatives documented how many households were employed in a particular industry, profession or trade and the number of unemployed within the village.

CHARACTERISTICS OF RURAL INLAND WATER TRANSPORT

Vessel Type

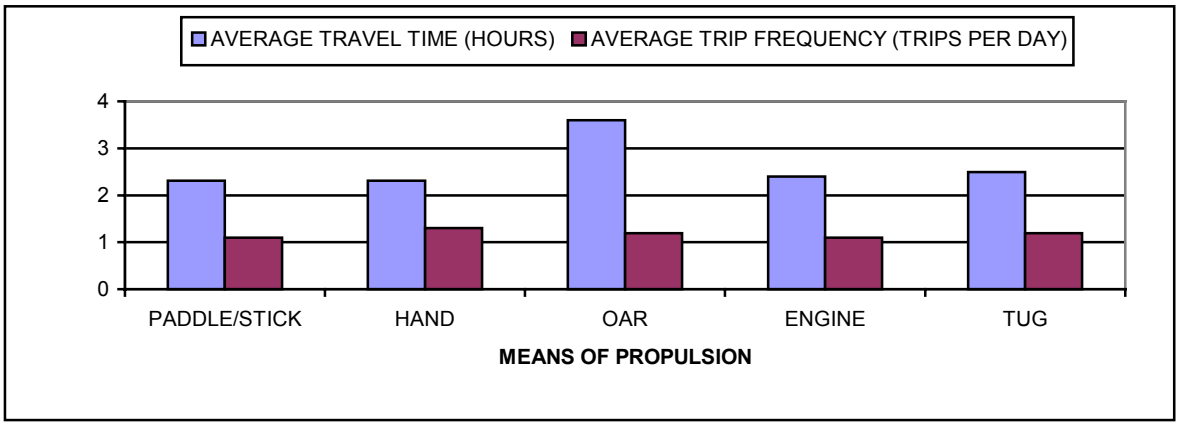
The household survey revealed that the average household in May Chreiy possessed two non-motorised vessels, with all households having access to at least one. Forty one percent of the sample possessed a motorised vessel. Of the total vessels in the village, 77 percent were non-motorised and 23 percent were motorised.



Graph 1: Vessel Frequency

Graph 1 shows that the most common vessel was a canoe propelled by paddle. These timber canoes are made locally and propelled by a person sitting or squatting at the back or front of the boat using a timber paddle. This vessel accounted for 64 percent of the total traffic. It is likely that this vessel is the most common, not only because it is the cheapest, but also because its size allows it to be operated in shallow water and therefore for more of the year. Its small size also allows it to be easily manoeuvred around obstacles. These vessels were also the most commonly used within the village centre. The household survey revealed they were the most common vessel used to visit friends, collect shopping from retail outlets, attend school and visit the pagoda.

The second most common vessel observed during the traffic count was the motorised longboat. These boats are wooden and made locally. The shape is adapted for the installation of a motor and propeller drive shaft. By using locally manufactured vessels, this village has the advantage of responding to changing technology with local innovation. These longboats are a perfect example of this innovation; the mechanics are simple, the engine has no gears and only one direction. This lack of manoeuvrability makes motorised longboats more suited to long straight trips. May Chreiy is eight kilometres from the nearest landing connecting it to the district road network and markets. This distance, plus the effort and time required to travel using non-motorised boats may contribute to the motorised longboat's high traffic count.

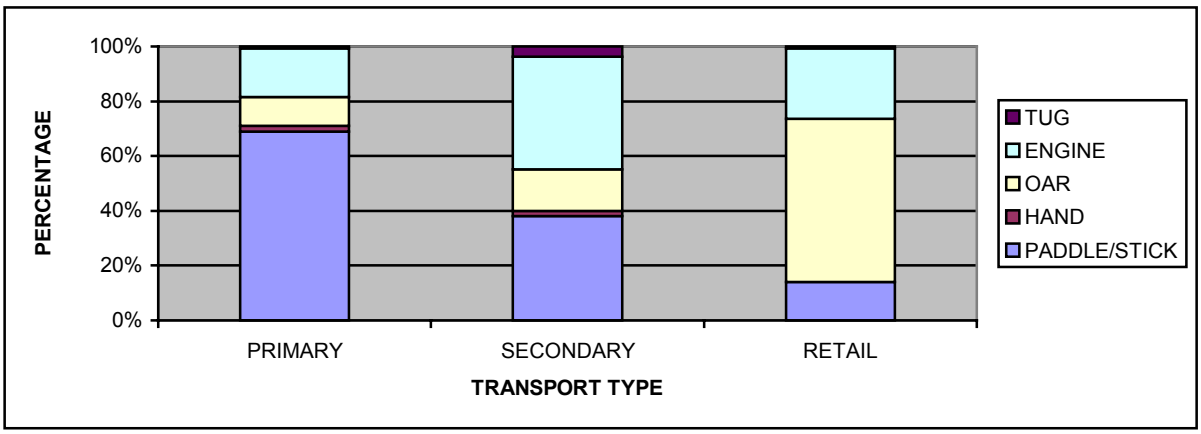


Graph 2: Means of Propulsion vs. Average Travel Time and Average Travel Frequency

A key measure of accessibility is the length of travel time required to meet needs. Graph 2 shows a comparison of propulsion type, frequency and travel time. These vessels are travelling for a variety of purposes that will be discussed in following sections of the report. It is interesting to note that average travel time and daily travel frequency are similar for the different propulsion methods.

On average, the travel time for vessels propelled by oar is the highest. Other means of propulsion exhibit similar average travel times with only an eight percent spread for the remainder. One reason for this, shown in Graph 3, is that oar propulsion is most commonly used for the transportation of retail goods. Most retail goods are obtained from Chong Teuk, where they are transported to and from the nearby district market at Puok. The average travel time for a return journey from the market depot at Chong Teuk to May Chreiy is 4.8 hours. This journey accounts for 37 percent of the journeys made by oar propelled vessels.

With the exception of vessels propelled by oar - whose high travel time may be attributed to its specific role as a retail vessel - the average travel time among the different means of propulsion is approximately 2.5 hours.



Graph 3: Means of Propulsion and Goods Transported

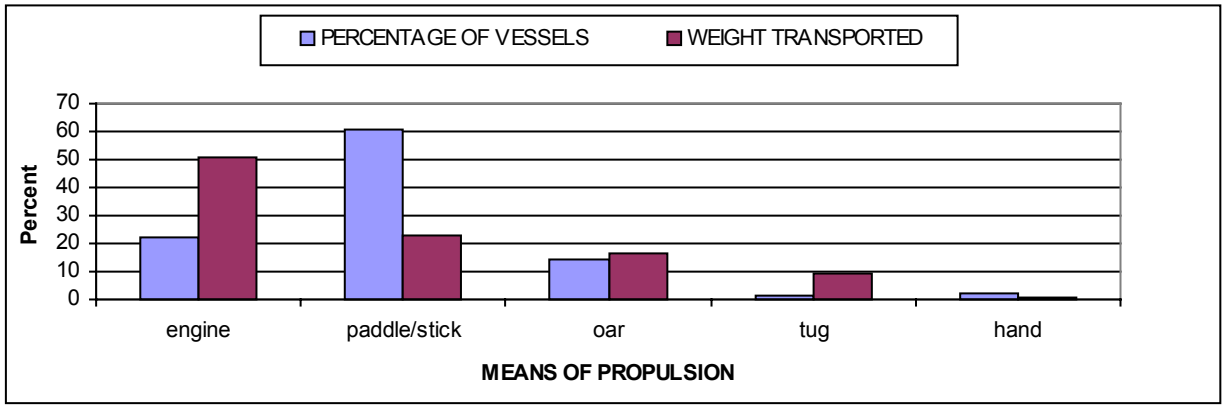
Transport has been divided into three categories:

- **Primary** – transporting goods from the point of production to point of sorting, transfer or sale.
- **Secondary** – transporting goods from the point of processing or sorting to point of transfer or sale.
- **Retail** – transporting of goods for retail purposes

Definite patterns were observed between vessel role and vessel type. Graph 3 shows that vessels propelled by paddle or stick, which are predominantly small, locally made wooden canoes, play the leading role in the transport of primary products.

Vessels propelled by oar make up 60 percent of the vessels transporting retail products. These vessels tend to be larger, with the driver or drivers standing upright using the whole body in the rowing action. This posture is more easily sustained over longer journeys and as mentioned, 37 percent of these vessels are destined for Chong Teuk, a 4.8 hour return journey.

Motorised vessels transport a large proportion of secondary products at 41 percent. It appears that the main role of motorised vessels is to transport goods from the point of production to the point of further processing or sale.



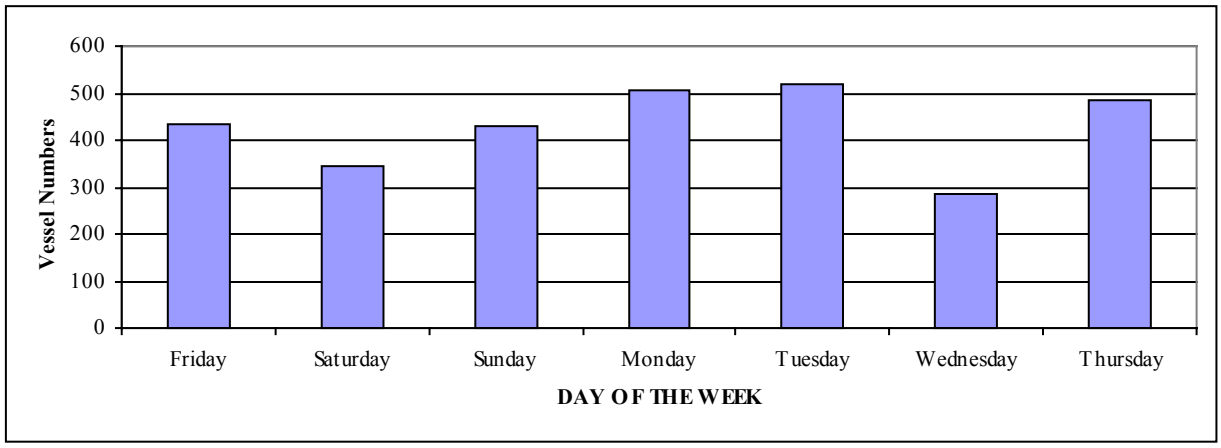
Graph 4: Means of Propulsion and Weight Transported

Graph 4 compares propulsion type with weight transported and the vessel population percentage. Motorised vessels carry 51 percent of the total weight although they only make up 20 percent of the vessel population. Vessels propelled by paddle show the opposite pattern, transporting 20 percent of the total weight while representing 61 percent of the vessel population.

There are obvious reasons for the main travel burden to be placed on motorised vessels rather than the smaller paddle powered canoes. Large increases in weight can be transported for a proportionally small increase in effort. For the other vessel types, any increase in weight transported results in a considerable increase in effort. Despite the advantages in efficiency of motorised vessels, high costs and poor manoeuvrability limit its popularity.

Traffic Flow Comparison

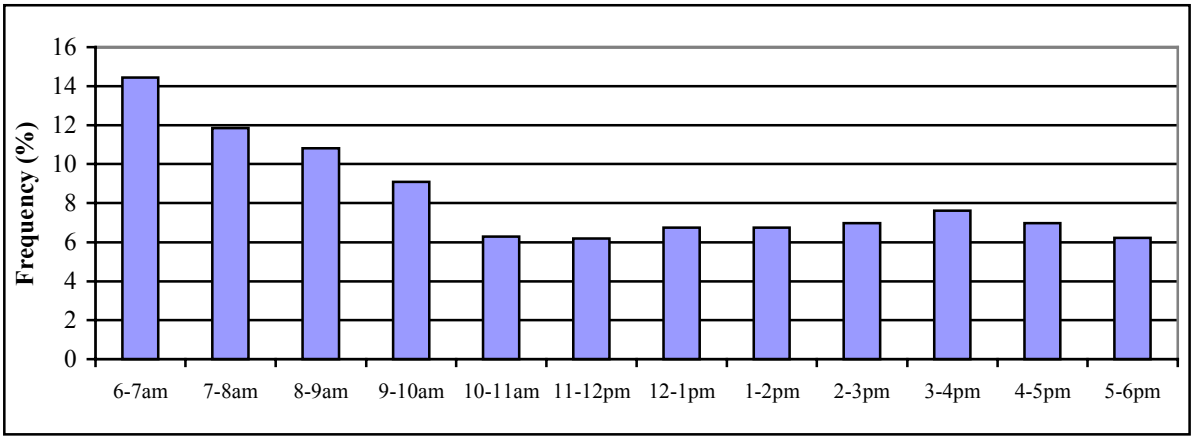
During the wet season, the water in the Tonle Sap swells until the only visible evidence of canals are the tree canopies that line them. At the time of this survey, May Chreiy was flooded with around four metres of water. This is overflow from the Tonle Sap and is consistent from year to year.



Graph 5: Daily Traffic Count

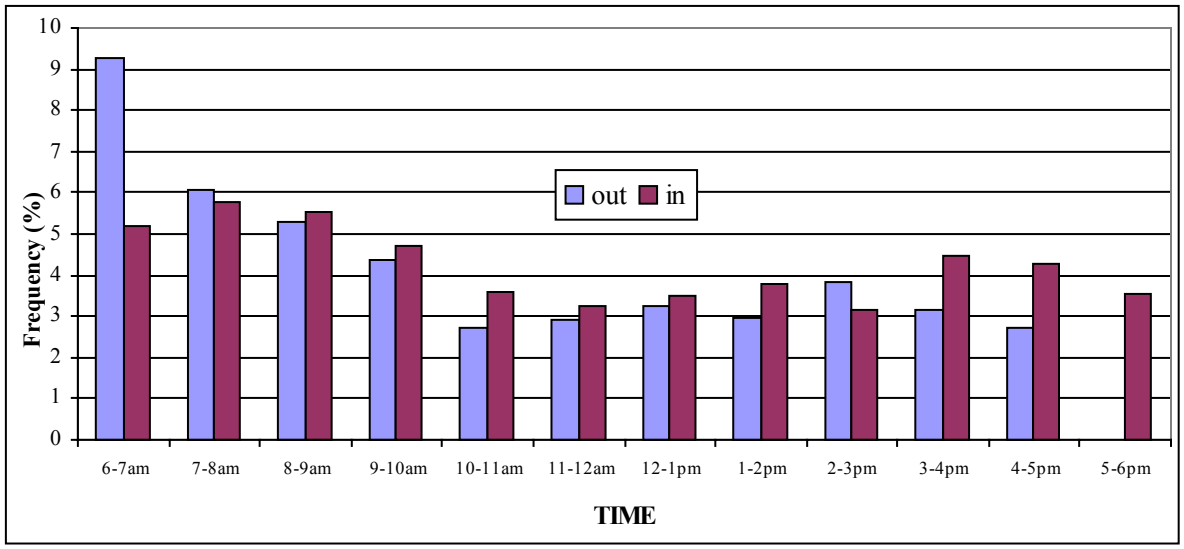
Graph 5 shows the differences in the daily volume of traffic. The village chief reported that the villagers work consistent hours seven days per week. It was also reported that the vast majority of trips made outside the village centre were for work purposes. Despite this, distinct variations were noted in the traffic flow for the different days of the week. It is apparent that the traffic flow on the weekend is less than during the week. Monday and Tuesday had consistently high traffic flows while Wednesday showed a dramatic reduction. Thursday and Friday returned to levels similar to those before Wednesday.

These differences in weekday traffic flow may be attributed to the weather or special events. Beginning on Friday, the weather was fine, with little or no wind until Tuesday. Wednesday, with a lower traffic count, was stormy with high winds and heavy rain. On Thursday, intermittent light showers persisted for most of the day with little wind. On Sunday morning, a feature kickboxing match was televised. There was a distinct depression in the traffic flow between 8 a.m. and 12 p.m. and for the remainder of this day, the flow was consistent with the average. Graph 6 shows the average traffic flow over the seven days for each hour of the day.



Graph 6: Average Traffic Flow by Hour

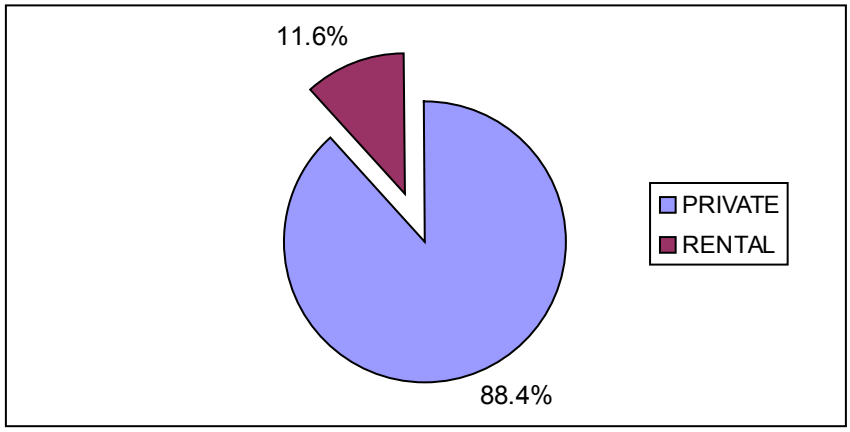
The majority of the traffic flow occurs early in the morning. By 11.00 a.m., 52.5 percent of the total day's flow had passed the traffic count locations. A depression occurred during the middle of the day, which may be because villagers return home for lunch. A consistent flow of traffic was measured for the remainder of the day. To get a complete picture of the flow that constitutes this average, a comparison of the inward and outward flow can be made. The following graph shows the percentage of the total traffic in and out of the village per hour.



Graph 7: Comparison of Inbound and Outbound Traffic

In the early hours of the morning, the outbound traffic flow is higher than the inbound traffic flow. The villager's main source of income is fishing. In the mornings, some villagers leave to fish and others travel to Chong Teuk to purchase supplies. Traders from the nearby villages of Chong Teuk, Ang and Phnum Kraom spend the early morning travelling from their villages to May Chreiy and do not arrive until mid morning. As expected, this pattern is reversed in the afternoon.

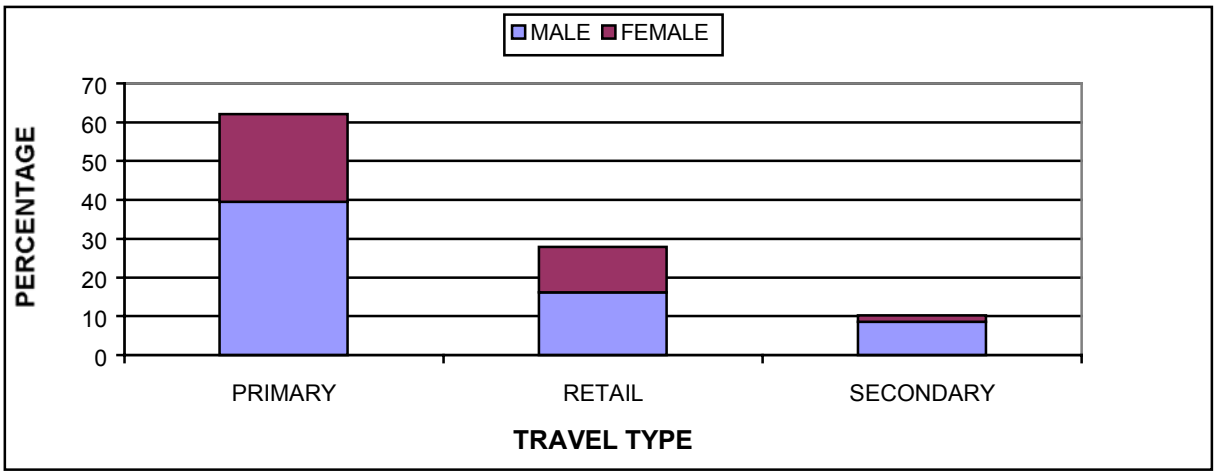
Climate also influences the flow of traffic. The typical working day in Cambodia begins at 7 a.m. with a break from 12 p.m. to 2 p.m. and finishing at 5 p.m. This morning focus has arisen because of the extreme temperatures from noon until sundown. A combination of the climate and the tendency for fishing to be more productive in the early part of the day may explain the high morning traffic.



Graph 8: Vessel Ownership

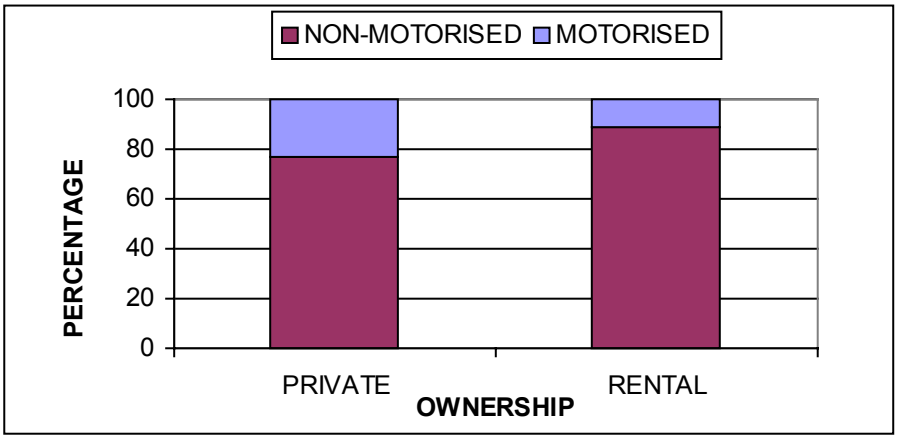
Ownership

The study found the majority of vessels in May Chreiy – 88.4 percent - were privately owned. The remaining 11.6 percent were rented. Eighty one percent of the rented vessels were rented on a daily basis. The remaining 19 percent of rented vessels were spread evenly between long-term rental, shared use and taxi ownership. As shown by the traffic count, the majority of vessels using the waterway are wooden canoes made by local people from local materials. The reason for high levels of ownership may not be the relative wealth of these people but the low cost of vessel construction and high skill level of waterway users.



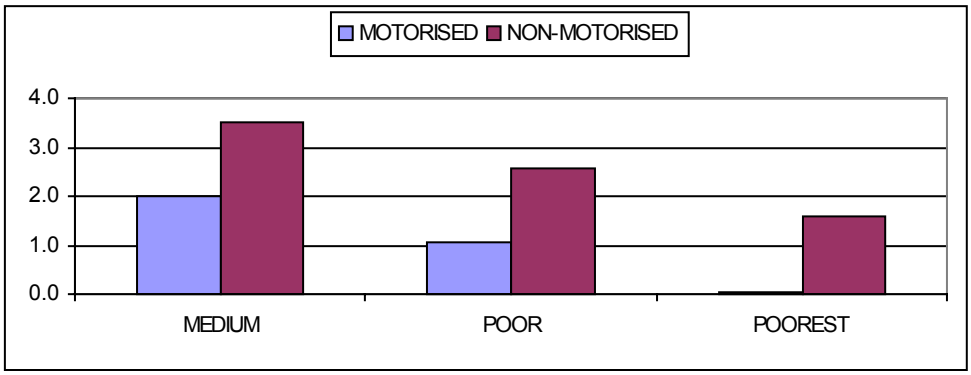
Graph 9: Percentage of Rented Vessels by Travel Type and Gender

Sixty two percent of rented vessels were used for primary production purposes. Thirty six percent of people renting vessels were female.



Graph 10: Vessel Type and Ownership

The majority of rented vessels were non-motorised, with a larger proportion of motorised vessels privately owned. This is surprising, as motorised vessels are more expensive.

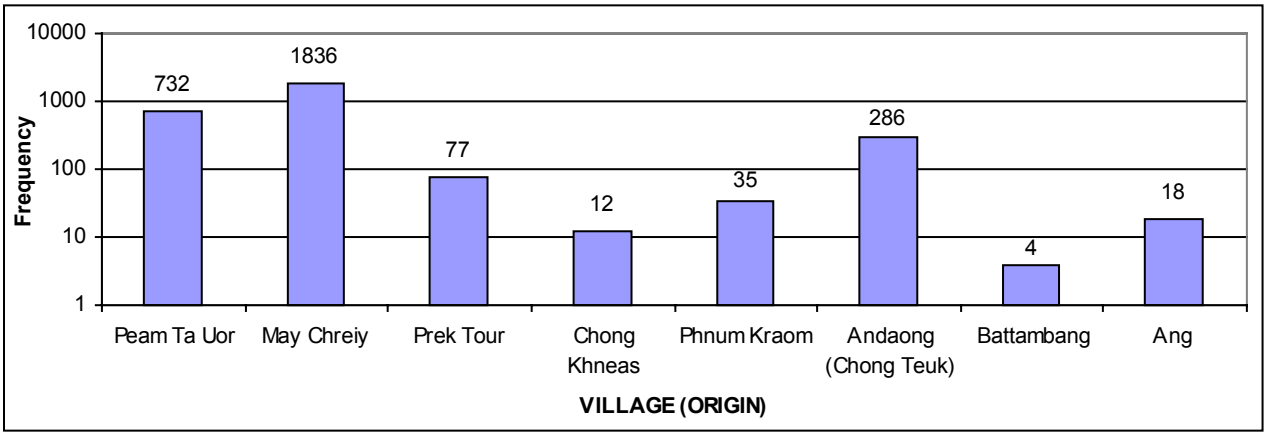


Graph 11: Wealth Classification vs. Number and Type of Vessels

It was found that the average wealthy or 'medium' household owned two motorised boats and 3.5 non-motorised boats. Poor families had one motorised boat and 2.6 non-motorised boats while the poorest of the poor, on average, possessed 1.6 non-motorised vessels. These ownership findings were higher than those reported by village key informants during the wealth ranking exercise while still confirming the wealth categories. Graph 11 illustrates the relationship between wealth classification, type and number of vessels per household.

Inter Village Traffic

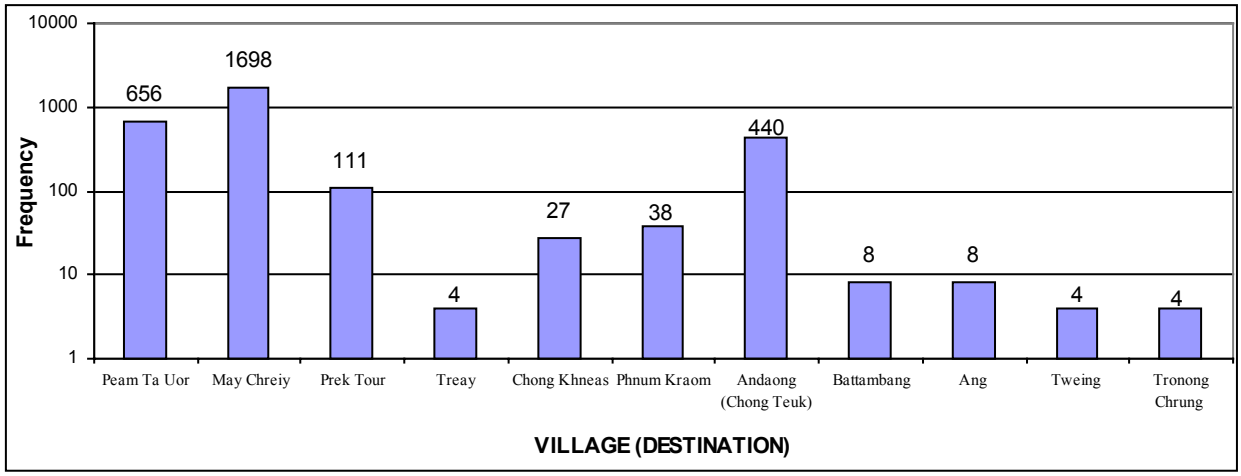
To discover the inter village traffic movements, an extrapolation of the O&D data was made. This was done by determining the proportion of vessels that originated in or were destined for a particular village and then using the data from the traffic count to estimate vessel numbers.



Graph 12: Number of Vessels and Village of Origin

Graph 12 plots the results of this extrapolation showing the number of vessels (seven-day total) versus the village of origin. Most vessels came from May Chreiy, although significant numbers came from Andaong and Peam Ta Uor. Fifty percent of the vessels from Peam Ta Uor transported passengers and 35 percent transported firewood. The majority of vessels from Preaek Toal, Chong Khneas and Phnum Kraom transported passengers. Andaong is the closest village connected to the road network and market centre. Vessels from Andaong transported a variety of products, the most common were fresh vegetables, rice and fruit. These products cannot be obtained nearby during the wet season.

The following graph shows the frequency of vessels (seven-day total) versus the destination village.



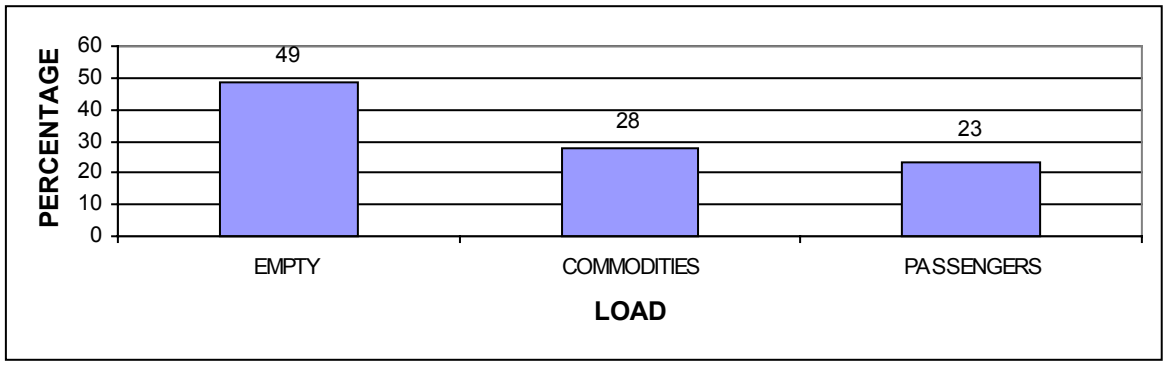
Graph 13: Number of Vessels and Village of Destination

Again, most vessels were destined for May Chreiy. A significant number of vessels were also bound for Andaong and Peam Ta Uor. Passengers were the most common load (49%), followed by firewood (17%), fish (15%) and fresh vegetables (8%). Seventy percent of vessels travelling to Peam Ta Uor were transporting passengers. The most common commodity transported to Andaong was fresh seafood (51%), with passengers accounting for 32 percent of these trips. The villages of Chong Khneas and Phnum Kraom are close to the road network connecting them to the markets in Siem Reap. Forty seven percent of the

vessels travelling to these villages transported passengers and 37 percent transported fresh seafood. It is reported that fish products attract higher prices at the Siem Reap market than at Puok market. However, due to the additional time and distance, it is apparent that few traders transport their goods to Siem Reap.

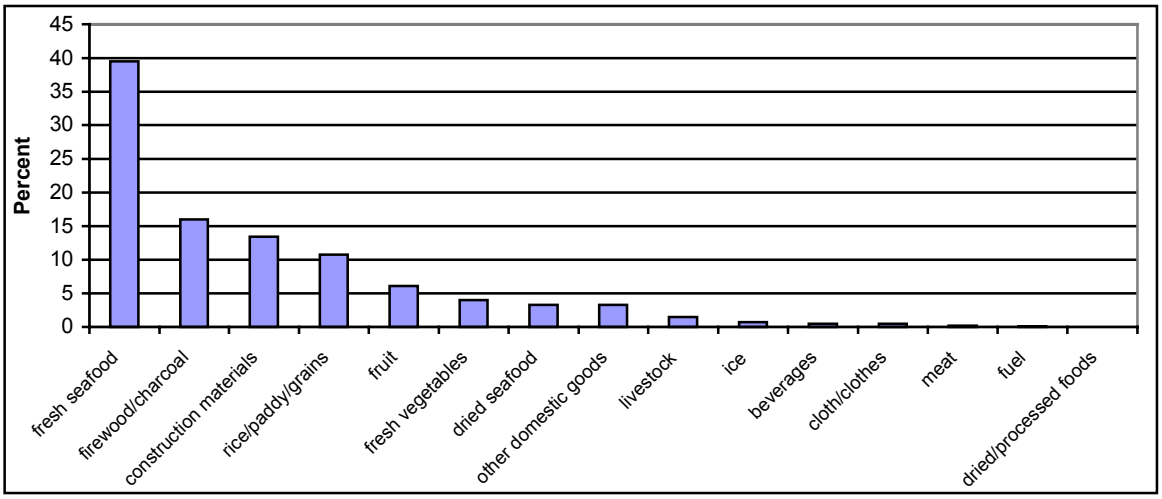
Load

Graph 14 compares three load categories: empty, loaded with commodities and loaded with passengers. Forty nine percent of interviewed vessels were travelling empty, 28 percent transported commodities and the remaining 23 percent transported passengers.



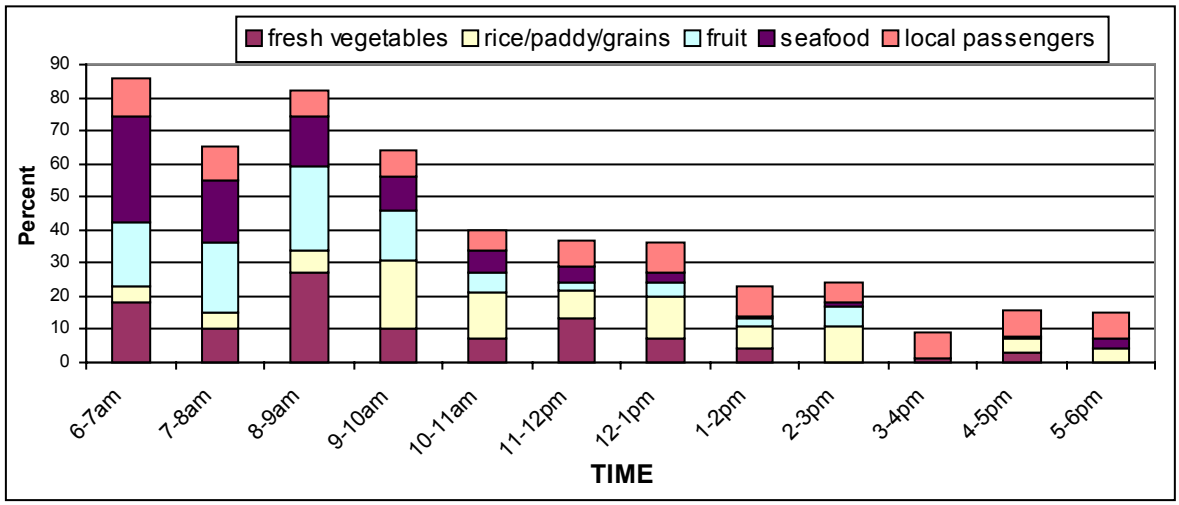
Graph 14: Vessel Load

An indication of the efficiency of transportation can be obtained by considering the proportion of vessels travelling empty. Graph 14 reveals that almost half of the vessels interviewed travelled empty. As 76 percent of traffic passing the survey locations were interviewed, it can be concluded that between 38 percent and 49 percent of all vessels travel unloaded. It is logical to deduce that the majority of vessels travelling in and around the village of May Chreiy travel half of their journey empty, while returning with either commodities or passengers. This suggests that there are inefficiencies in the use of water transport.



Graph 15: Commodity as a Percentage of Total Weight Transported

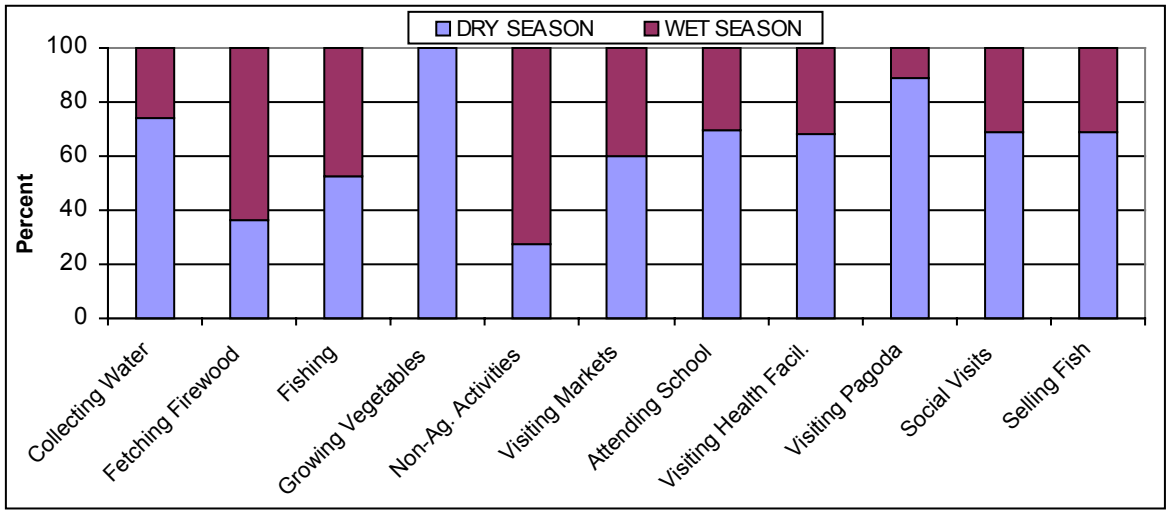
Seafood accounts for almost 40 percent of the total weight of commodities transported. Over 38 percent of surveyed vessels were carrying this product. This finding further illustrates the village reliance on fishing and the inland water system that links them to the fishing grounds of the Tonle Sap. The second most transported commodity was firewood, collected mainly from the surrounding woodlands.



Graph 16: Transportation of Commodities per Hour

Travel Time

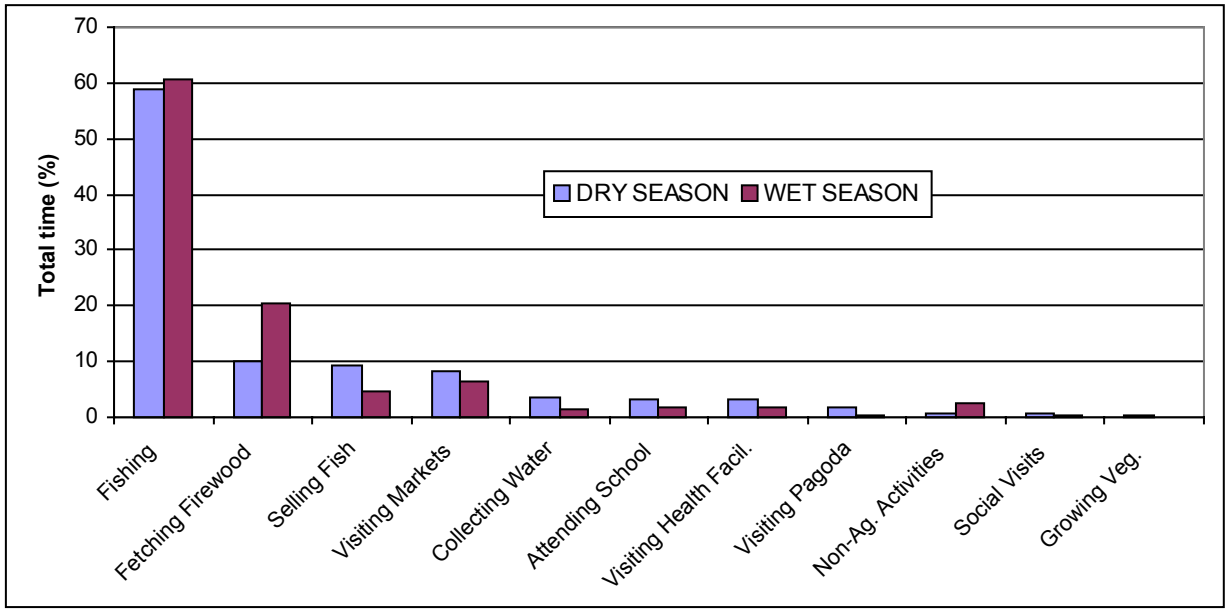
As can be seen in Graph 16, fish, fruit and vegetables were most commonly transported in the early hours of the day. The number of vessels transporting these products reduces dramatically in the latter part of the day, while the number of vessels transporting passengers and rice remains constant.



Graph 17: Relative Time Spent per Activity by Season

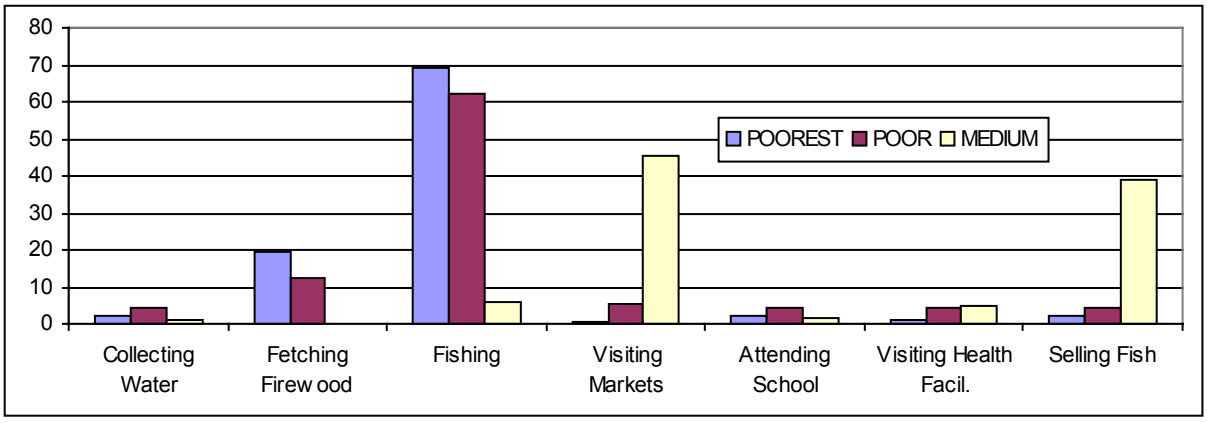
Graph 17 gives a comparison between the time spent carrying out a range of activities in the wet and dry seasons. With the exception of collecting firewood and involvement in non-

agricultural activities, villagers spend less time carrying out basic activities in the wet season than in the dry season. During the wet season, most destinations are reachable by water. During the dry season, villagers need to travel over water for a portion of their trip and over land for the remainder. Travel times during the dry season are generally higher because of the poor condition of roads - which are submerged for up to six months of the year – and the need to change transport mode.



Graph 18: Percentage of Time Spent per Activity by Season

As can be seen in Graph 18, almost 60 percent of the villagers' time is spent fishing. A considerable amount of time is also spent selling the catch. The floating village moves with the level of the Tonle Sap, to allow villagers access to the fishing grounds by boat. The reason for this comparatively high total travel time is the high number of trips rather than difficult and time consuming journeys to fishing grounds.



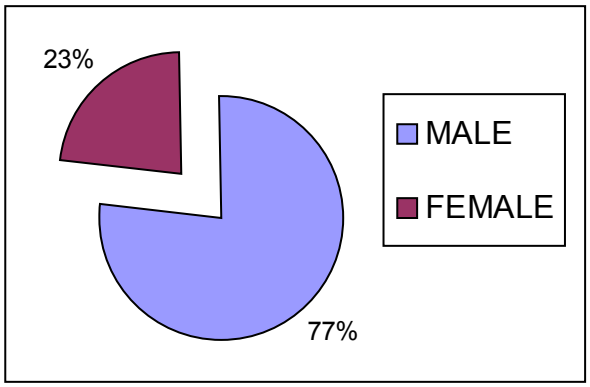
Graph 19: Percentage of Time Spent per Activity by Wealth Ranking

Different travel patterns were observed for households of different wealth ranking. Families ranked as the most wealthy, described as 'medium,' spent 85 percent of their time either at

the market or selling fish. Families described as 'poor,' spent 62 percent of their time fishing and 12 percent collecting firewood. These families also spent some time attending school, selling fish and visiting markets. As Graph 19 shows, poor families, described as the 'poorest of the poor,' spend 70 percent of their time fishing and 20 percent collecting firewood, leaving little time for other activities. It is therefore evident that poorer households spend more time in primary production activities than wealthier households. Overall, it was found that wealthy households spend more time travelling per day. Medium households travel an average of ten hours per day, a poor household travels four hours per day and the poorest of the poor travel for six hours per day.

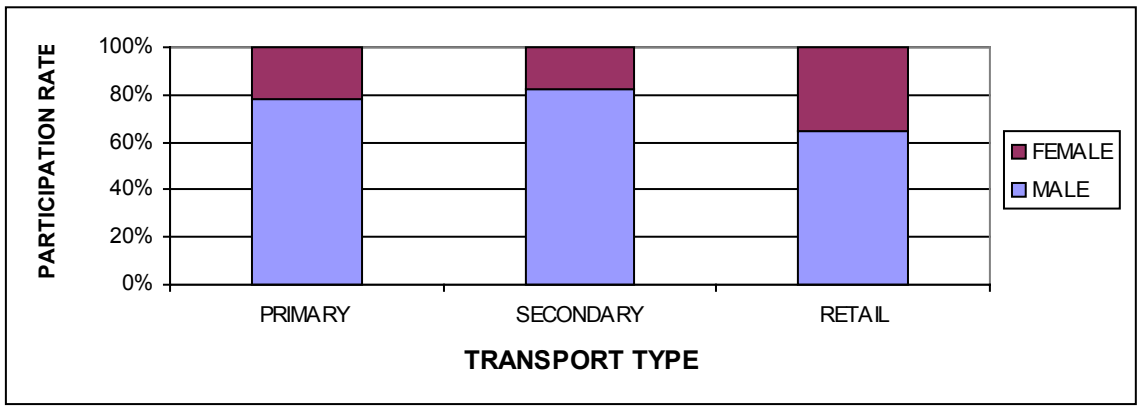
Gender

Both the O&D survey and the household survey found that the travel and transport burden fell mainly on the men in the village. As Graph 20 shows, men travel 77 percent of the total household time. The average household spends five hours per day on the waterways. Men travel almost four hours per day, while women travel a little over one hour per day.



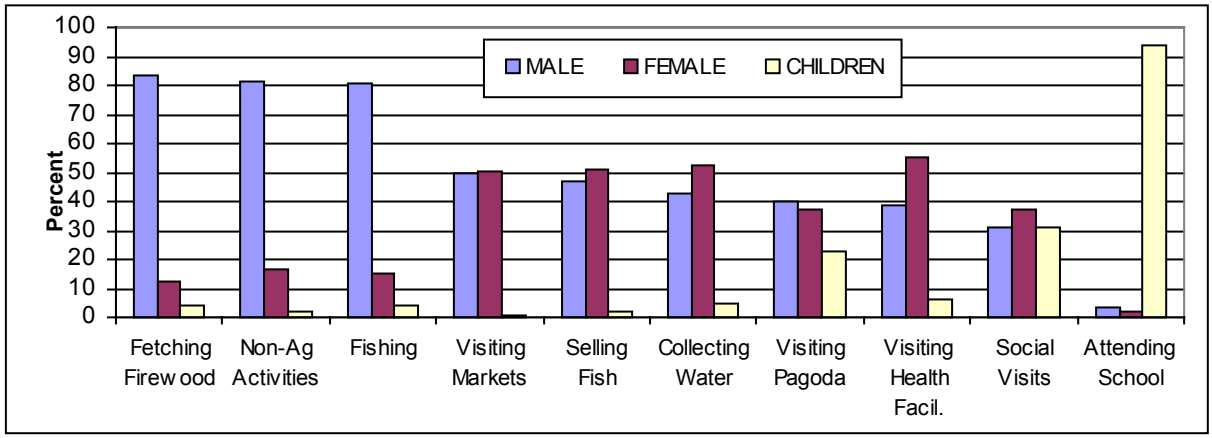
Graph 20: Total Travel Time vs. Gender

The O&D survey gave a general understanding of the purposes of transport whether it be transporting commodities for primary, secondary or retail purposes. The following graph shows the relationship between gender and transportation type.



Graph 21: Gender and Transport Type

A national census conducted in 1998 recorded that 48 percent of the population in Siem Reap Province (where May Chreiy is located) were male. Although there is an almost equal population of men and women within the village, it can be seen that males dominate the use of the waterways. It is interesting to note that travel for retail purposes has the highest female participation rate, with 35 percent.



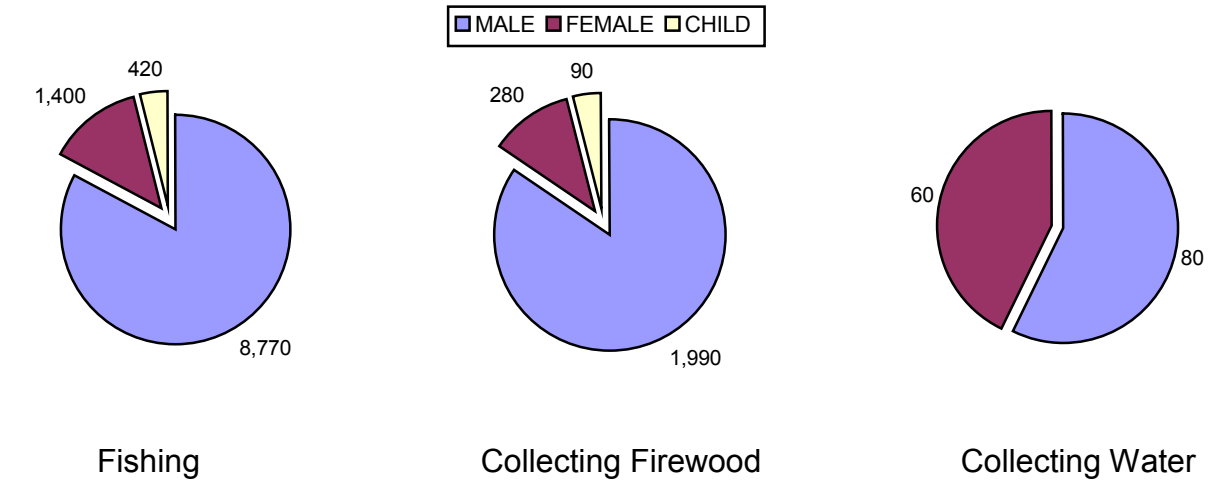
Graph 22: Relative Time Spent by Activity and Gender

The household survey gives a detailed understanding of the activities carried out by men, women and children. The survey defined children as those under 15 years. Graph 22 gives a comparison of the time spent by men, women and children for each travel activity. Men play a leading role in collecting firewood, non-agricultural activities (like mechanics, building and other wage labour) and fishing. Men spend 67 percent of their total travel time fishing, 17 percent collecting firewood and visiting markets while selling fish accounts for ten percent.

Men and women spend almost equal time visiting markets, selling fish, collecting water and visiting the pagoda. It has been shown that women spend a comparatively small proportion of their time travelling. As a proportion of their total travel time, women spend 41 percent fishing, 12 percent visiting markets, and 16 percent selling fish. Children spend 39 percent of their travel time fishing and 38 percent attending school. Children also spend nine percent of their travel time collecting firewood.

Although women spend proportionally less time on the waterways, they make more trips than men, although these trips are shorter. On average women make 30 trips per week, men make 25 trips and children make eight trips per week. Fifty percent of the trips for men and 60 percent for women are for collecting water. The village is located on the Tonle Sap and the same water is used for cooking and consumption. Due to the relative ease of collection, the travel time to collect water constitutes a very small proportion of the total.

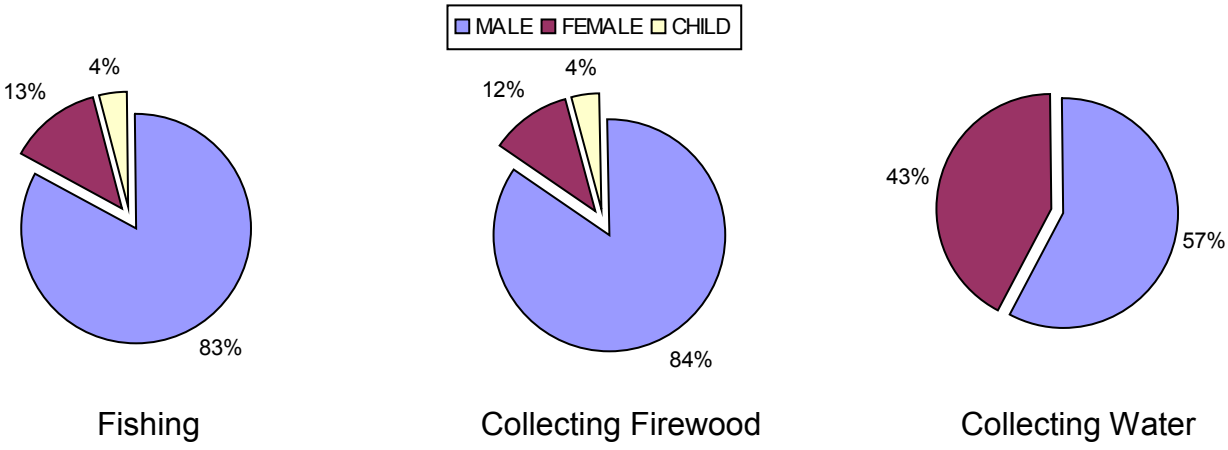
It has been shown that men, women and children all spend the majority of their time fishing. Fishing however, only constitutes 26 percent of the total number of trips for men, five percent for women and eight percent for children.



Graph 23: Average Daily Distance Travelled by Activity and Gender (metres)

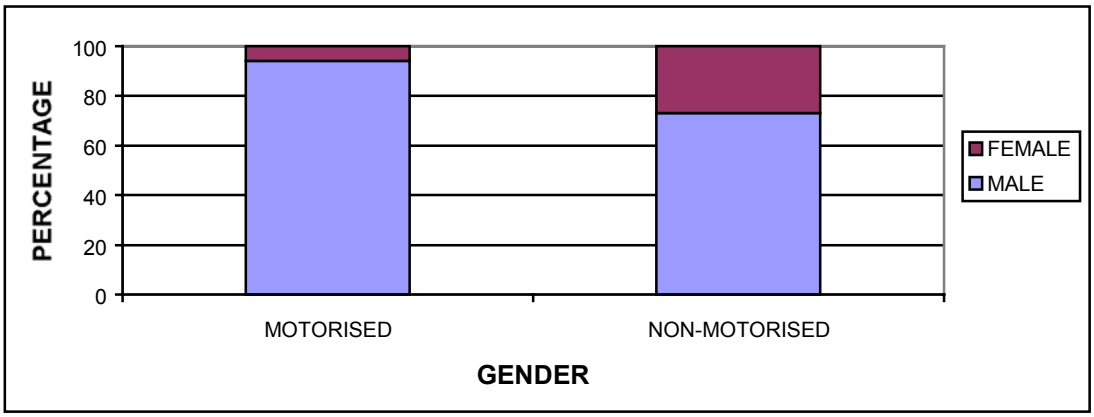
Men travel 14.5 kilometres per day, which represents 70 percent of the total daily distance travelled per household. Women travel an average of 5.5 kilometres per day and children almost 700 metres. Ten kilometres or 50 percent of the total distance travelled in a day is for fishing. Over two kilometres or eight percent is travelled to collect firewood and the most basic task, collecting water, accounts for only 140m per day.

The proportion of distance travelled per activity by men, women and children is consistent with the trends observed when comparing time to gender.



Graph 24: Average Transport Effort by Activity and Gender

To obtain a quantitative comparison of effort, the product of total weight transported and total distance travelled was calculated. For the purposes of comparison, fishing, firewood and water collection were compared. Again, men dominate the statistics. It can be said that the travel burden in the village of May Chreiy, is placed on men. They spend more time travelling, travel longer distances and transport the most weight.



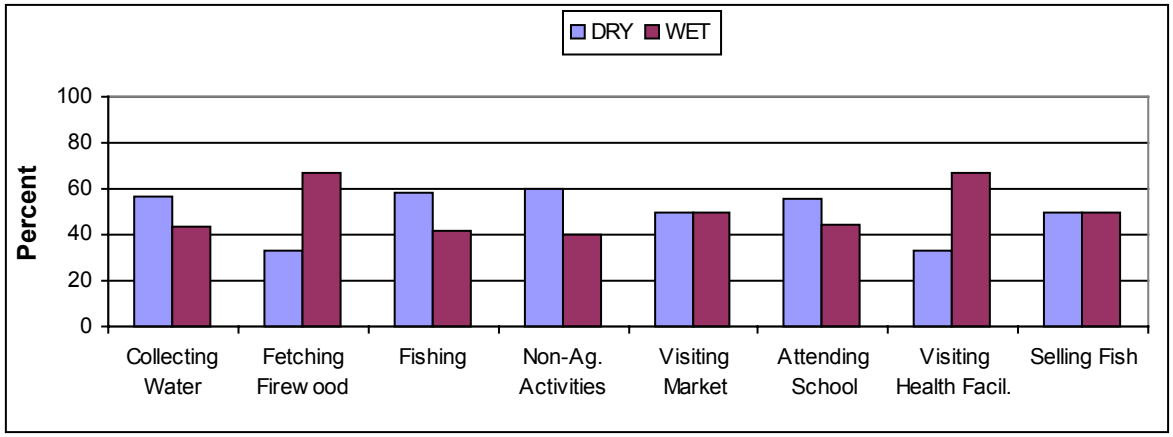
Graph 25: Gender and Vessel Type

It is interesting to note the relationship between gender and the different propulsion methods. Graph 25 compares the vessels used by men and those used by women. It can be seen that 94 percent of those using motorised vessels are male.

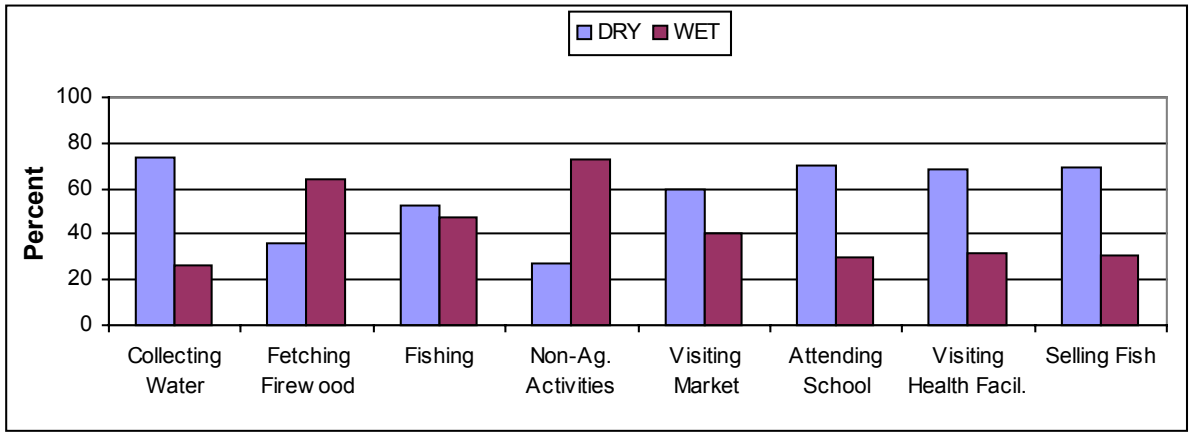
The majority of motorised vessels are powered by inboard diesel engines. These engines are started using a crank, which requires considerable strength to rotate at the required speed to initiate combustion. This may prevent more women from using this means of propulsion.

Travel Activities

Responses to the household survey allowed a comparison of village travel patterns during the wet and dry seasons. There was only a small variation in trip numbers between each section as Graph 26 shows.

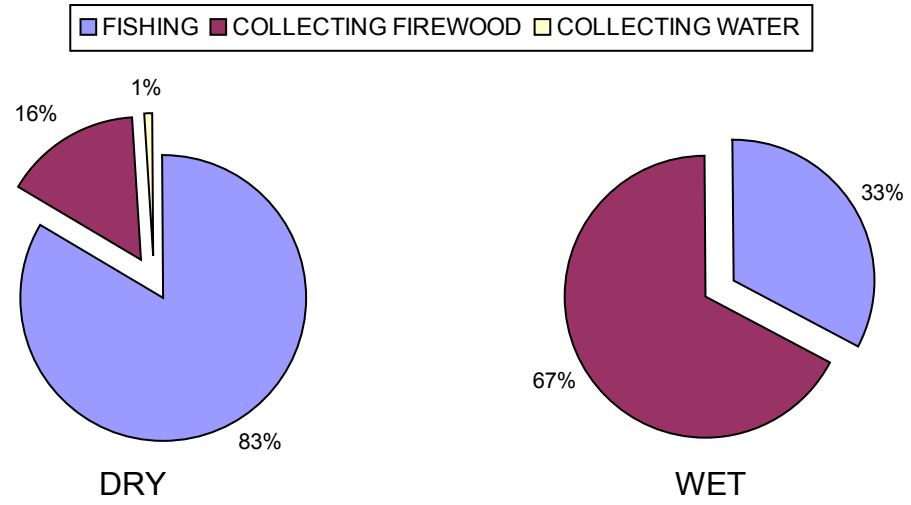


Graph 26: Comparison of Trip Numbers by Season



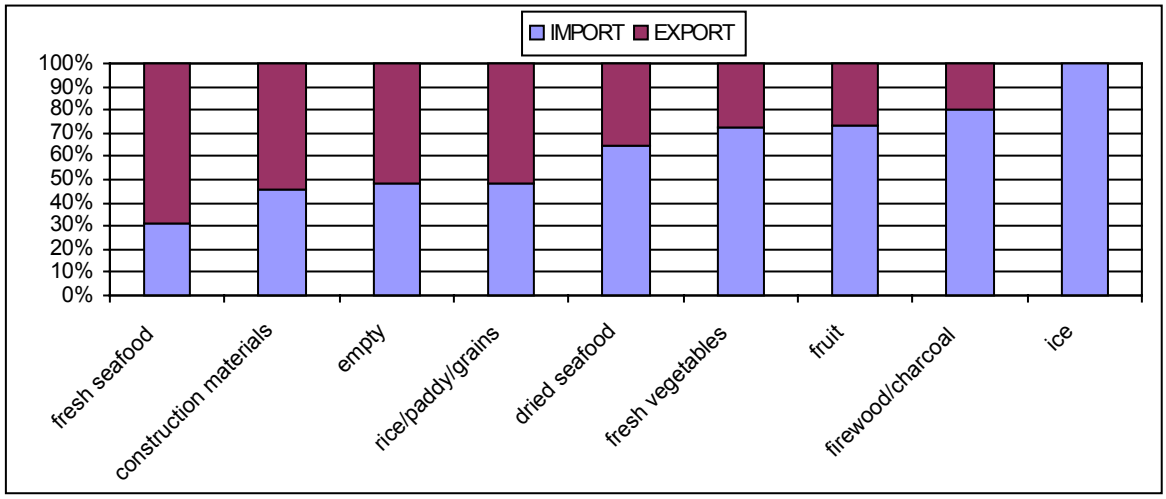
Graph 27: Comparison of Trip Time by Season

Although the number of trips in the wet and dry seasons were similar for most activities, seasonal differences were noted in travel distance and time. As Graph 27 shows, the time required to carry out activities in the dry season is generally higher than in the wet season. A similar trend exists for the distance travelled during the different seasons. The average travel speed of vessels was 4.7km/h in the dry season and 4.4km/h in the wet season. Speed however, is not a true measure of effort. The effort required to transport commodities is measured in terms of weight and distance. It was found that the overall effort required to transport commodities during the dry season is 65 percent higher than during the wet season.



Graph 28: Average Transport Effort per Activity and Season

During the dry season, the effort required to fish is greater, due to the greater distances travelled to the fishing grounds. Fishing during the dry season is also less productive as the volume of water in the Tonle Sap is reduced by a factor of approximately eight, which affects the fishing catch. The village chief reported that firewood collection was easier in the dry season. Results from the household survey indicated the opposite. Following discussions with villagers, it was reasoned that due to the difficulty collecting firewood in the dry season, villagers purchase the fuel rather than travel to collect it, therefore expending less effort.



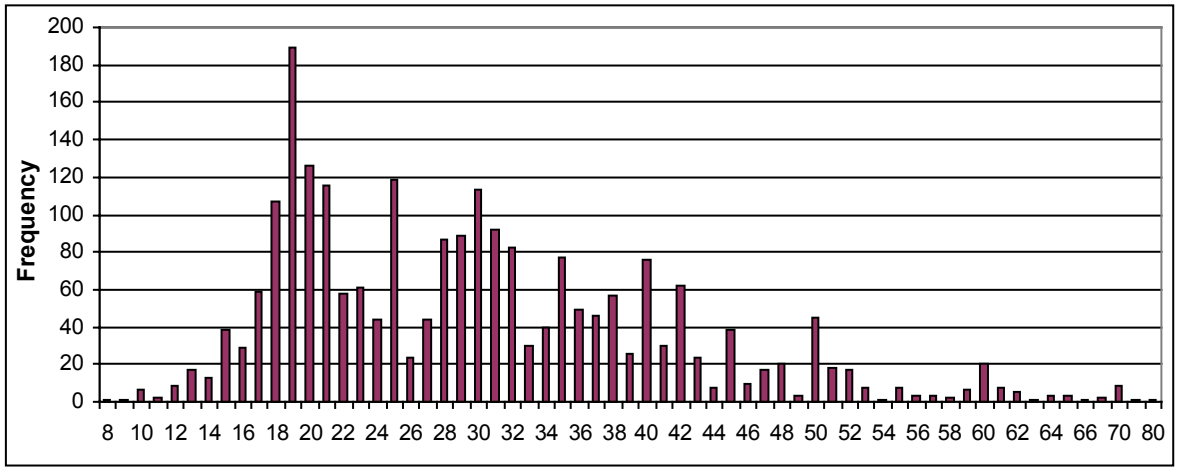
Graph 29: Proportion of Commodities Imported and Exported

The O&D survey provides an indication of the goods imported and exported by the villagers. Graph 29 was derived by determining the proportion of vessels transporting each commodity to May Chreiy and the proportion destined for other villages. The purpose of this comparison was to obtain an idea of which products the village attracts and which products pass through the village.

Fresh vegetables, fruit, firewood and ice are commodities that the village obtains from other locations. The main commodity leaving the village is fresh seafood. There are geographical explanations for these trends. The survey took place at a time of the year when the village was flooded. People live on floating houses, unable to engage in agriculture and with limited access to power. A few members of the community can afford electric power in the form of truck batteries that are recharged by a diesel generator located within the village. Fishing is most productive during this time of year and the surplus of fish can be traded for other commodities.

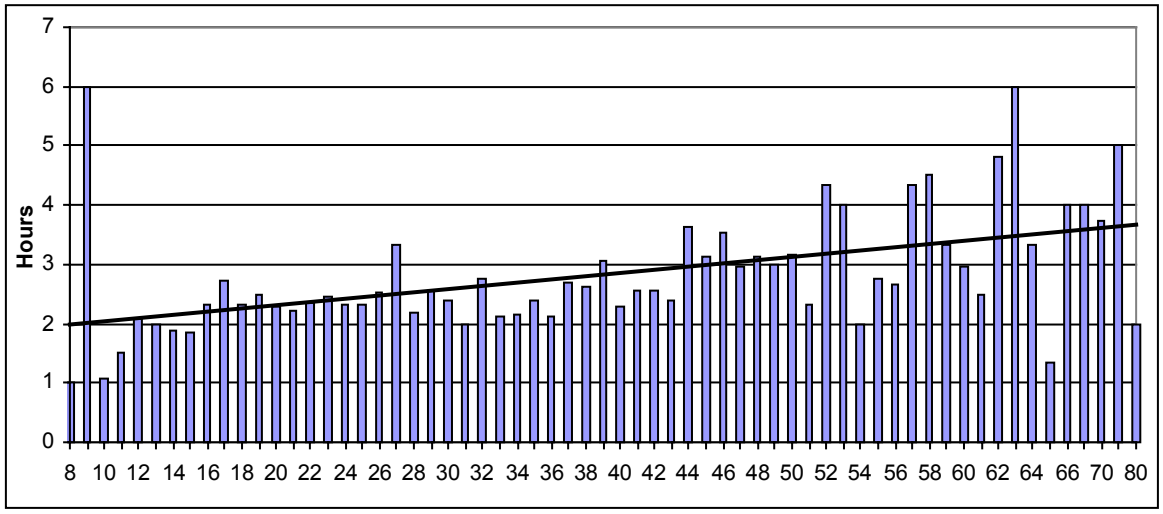
Age

Cambodia's unique history may have affected the rate of different age groups using water transport in May Chreiy. The Khmer Rouge regime forced many villagers to abandon their former lives and work for the regime. Through execution, starvation and harsh conditions, many people including children and the elderly died. The effect on village population distribution is unknown hence the observations relating to age may not give a true indication of the natural trends. The age distribution of community members using inland water transport is shown in Graph 30.



Graph 30: Age and Frequency

The average age of a vessel driver is 29 years, however 50 percent of vessel drivers are under the age of 28. According to the 1998 census, the average age in Cambodia is 21 and 50 percent of the population are under 32 years. Water transport users in May Chreiy are older than the Cambodian average. The average age of a motorised vessel owner is 33 and the average age of a non-motorised vessel owner is 29.



Graph 31: Age and Average Travel Time

It is interesting to compare the average travel time with age. Graph 31 illustrates that as age increases, average travel time increases.

ACCESSIBILITY

Accessibility is defined as the ability to reach use or visit. Access provides people with the opportunity to satisfy their subsistence, social and economic needs and facilitates employment opportunities.

Accessibility has traditionally been measured by proximity, ease of travel and travel costs using roads, paths and tracks. By obtaining a better understanding of rural inland water transport and its role in meeting accessibility needs, water transport can be incorporated into planning procedures resulting in a more generic and comprehensive approach to the evaluation of accessibility.

Integrated Rural Accessibility Planning is a local level planning tool used by the International Labour Organisation that approaches planning issues through accessibility. IRAP has been developed to improve the living and working conditions of rural populations. The aim is to ensure that available investments are directed towards the most urgent needs of local communities. IRAP uses participatory methods to identify areas that lack accessibility and uses information gained at the village level to prioritise future investments. Access can be improved in a variety of ways – by improving transport means, infrastructure and services or by improved proximity to services.

The Cambodian Riel has been used to report the cost of access for May Chreiy villagers. Approximately 4000 riel is equal to one US dollar. The average income for a Cambodian adult in May Chreiy is reported to be US$257 per annum. May Chreiy has a population of 1540 people in 215 households.

Access to Drinking Water

Drinking water in Cambodian villages is usually collected from wells, ponds, rainwater or from the Tonle Sap Lake. Rainwater and water from pump wells are typically the cleanest sources of drinking water, with hand dug wells, ponds and the Tonle Sap water being the least suitable for drinking.

Seventy percent of families within the village drink water directly from the Tonle Sap. The remainder live in houses with tin roofs that allow rainwater collection. During the wet season, the water surrounding the houses is relatively clean and villagers can collect water from their doorstep. There is therefore almost no travel time associated with water collection and it is collected four times per day. During the dry season, villagers relying on the Tonle Sap travel on average 30 minutes to a location with water more suitable for consumption. This journey is made six times per day. During the dry season, water on the edge of the Tonle Sap is polluted and needs to be boiled before consumption.

Access to Firewood

All May Chreiy villagers use firewood for cooking. Food is cooked in pots or woks on clay stoves inside the floating timber home.

The average villager collects firewood from the forest at Oh Brortorb. During the wet season, it takes two hours to travel to the forest at a cost of 10,000 riel ($2.5US). Travel is by paddle canoe and occurs four times per month. Time and cost is the same during the dry season. During the dry season however, the journey is made eight times per month. During the wet

season, the forest is flooded and timber is collected from the abundant tree canopies, easily accessible by boat and stripped by hand. During the dry season, the timber must be collected from the ground, collection is less productive therefore trips are more frequent.

Access to Education

The IRAP planning procedure investigates access to both primary and secondary schools. There are 12 grades of schooling in the Cambodian education system. Primary, from grade one to six and secondary from grades seven to 12. All Cambodian tertiary facilities are located in the nation's capital, Phnom Penh. Acceptance into a tertiary facility requires the completion of grade 12.

A new school has recently been constructed within the village. This consists of three floating buildings each with two rooms. The new school has five classrooms and one administration room. There are five teachers working at the school, teaching grades one, two and three. Of the 1540 people within the village, 313 are aged between six and twelve. The school is attended by 253 pupils. There are no travel costs to attend school and the travel time is negligible. The school moves with the village, hence access is the same in the wet and dry seasons.

The closest secondary school to May Chreiy is situated in Prohut Village, Lvea Commune in Puok District. Seven students attend secondary school and all board closer to the school. During the wet season, it takes two hours and an equivalent cost of 2000 riel ($0.5USD) to travel from where the students board, to the school. During the dry season, it takes one hour 50 minutes to travel to school at an equivalent cost of 1500 riel ($0.38USD).

Access to Health Care

For accessibility planning, health care is defined as a hospital, health centre, pharmacy or a health worker. A hospital provides medical and surgical treatment and nursing care and is normally located at the district centre or provincial capital. A health centre provides basic medical treatment and nursing care and a pharmacy is defined as a place that sells essential medicines. Health workers include trained nurses, trained midwives, traditional birth attendants and other practitioners of traditional medicine.

The closest hospital is located at the provincial capital, Siem Reap. The most common route to the hospital is by water to Siem Reap port at Chong Khneas, then by road to the town. If there is a need to visit the hospital, it is typically an emergency. The average villager therefore uses a motorised boat to Siem Reap port and then a car to the hospital at the town centre. Cars are used, as the average patient journeying to the hospital is not capable of travelling on a motorbike. During the wet season, a journey to the hospital takes 2.5 hours by a combination of motorised boat and car. The cost of the trip is 70,000 riel ($17.5USD). During the dry season, the trip takes three hours and is again made by a combination of motorised boat and car. The cost is 80,000 riel ($20US).

The closest health centre is located in Kouk Russie village. Kouk Russie is located at the wet season edge of the Tonle Sap. During the wet season, the journey takes one hour by motorised boat, at a cost of 3000 riel ($0.75USD). During the dry season, it takes 80 minutes to travel there by motorcycle at a cost of 15000 riel ($3.75USD). The high cost is a result of the poor condition of the road and time required for the journey. Visits to the health centre are made three times per month, during both the wet and dry seasons.

The pharmacy in May Chreiy consists of a shop that sells three types of basic medicine - paracetamol, vitamin C and anti-diarrhoea medication. The village pharmacy is located in the village centre and is accessible by paddle boat in the wet and dry seasons. Travel time to the pharmacy is five minutes. The villagers make ten trips per month to the pharmacy during the wet season and 12 trips per month in the dry season with negligible transportation costs.

May Chreiy has access to a total of seven health workers within the village. There is one trained nurse, four trained midwives and two traditional birth attendants. There are no other practitioners of traditional medicine officially operating within the village.

Access to Markets

Villagers in May Chreiy have access to two major district markets. One within their own district at Puok and the other in the neighbouring district of Siem Reap. Both markets are difficult to access on a daily basis. Trips to the district markets are reduced as market traders come to the floating villages to purchase fresh fish. Retail vessels are also in operation, providing a convenient, although more expensive, source of basic household items and consumables.

The average villager sells products at a depot at the edge of the lake which relocates along the canal/road from Chong Teuk to May Chreiy. During the wet season, when the water level is high, the depot is located at Chong Teuk. It takes two hours to travel to the depot by motorised longboat at a cost of 3000 riel ($0.75US). This journey is made ten times per month. During the dry season, the depot relocates to May Chreiy, where the village population resides. The travel time to the market is then reduced to 15 minutes by paddle canoe, at no cost to the villager. This trip is made 15 times per month in the dry season.

The average villager travels to Puok market to purchase goods. This same location is used in both the wet and dry seasons. During the wet season, the journey takes 140 minutes using two modes of transport. A motorised longboat is used to travel to the nearest all weather road at Chong Teuk and then a motorcycle is taken to Puok market. This trip is made four times per month at a cost of 6000 riel ($1.5US). During the dry season, the same trip is made using only one mode of transport, a motorcycle. At this time of year it takes 80 minutes and costs 15000 riel ($3.75US). The trip costs more in the dry season, as the road that connects May Chreiy to Chong Teuk is in poor condition and few motorcycle taxi drivers are willing to travel this stretch of road. This trip is made twice per month in the dry season.

Access to the District Centre

The district centre is located at Puok, approximately 18 kilometres from May Chreiy. Access to the district centre is over a combination of water and land in the wet season and over land in the dry season. An all weather road connects the district centre to the village of Chong Teuk, situated at the high water level during the wet season.

Access to the district centre during the wet season involves two modes of transport. The trip is most commonly made using a motorised boat to Chong Teuk then a motorcycle to the district centre. It takes on average two hours and 20 minutes to travel to the district centre. The cost of the trip is 6000 riel ($1.5USD) and the trip is made three times per month.

The canal used by vessels during the wet season is dry and used as a roadway during the dry season. It takes on average, one hour and 40 minutes to travel to the district centre during this

time of year. The journey is made on motorcycle, four times per month at a cost of 15,000 riel ($3.75USD) per trip.

Following is a table summarising access times, costs and travel frequency in the wet and dry seasons for each of the IRAP indicators.

Service/need	Cost per trip/Wet	Cost per trip/Dry	Time per trip/Wet	Time per trip/Dry	Travel Frequency/Wet	Travel Frequency/Dry
Depot	$0.75	Nil	120 min	15 min	10 per month	15 per month
Puok Market	$1.50	$3.75	140 min	80 min	4 per month	2 per month
Firewood	$2.50	$2.50	120 min	120 min	4 per month	8 per month
Hospital	$17.50	$20.00	150 min	180 min	1 per 3 months	2 per 3 months
Health Centre	$0.75	$3.75	60 min	80 min	3 per month	3 per month
Pharmacy	Nil	Nil	5 min	5 min	10 per month	15 per month
Primary Education	Nil	Nil	Nil	Nil	-	-
Secondary Education	$0.50	$0.38	120 min	110 min	-	-
Drinking Water	Nil	Nil	Nil	30 min	4 per day	6 per day
District Centre	$1.50	$3.75	140 min	100 min	3 per month	4 per month

Table 2: Summary of Access by Season

Village Comparison

In February 2000, the ILO generated an 'Accessibility Action Plan' for Puok district. This plan outlined the current accessibility situation within the district, identified villages with poor access according to a series of indicators and identified methods to improve accessibility according to the priorities set. A comparison can therefore be made between villages that have access to roadways and those that rely on water transport. Puok district consists of 16 communes and 154 villages.

As mentioned, the overall village priority indicator is derived using both the calculated priority value and the villagers' perceived priorities. The village representatives reported that improved access to water and transport infrastructure were the most urgent priorities. Improved access to health care was their next priority, followed by access to education and finally markets.

The calculated priorities yielded similar results to the villagers' perceived priorities. Access to drinking water, transport infrastructure and markets were all identified as requiring urgent improvement. Improved access to health care was identified as the next priority, then access to education.

It was found that 91 percent of the villages in Puok have better access to markets than May Chreiy. The majority of villages with good access to markets are those close to the national highway. The national highway provides access to the district market at Puok and to the

provincial capital, Siem Reap. May Chreiy's connection to the national highway is via a canal during the wet season and roadway during the dry season, both of which are in poor condition. An improved canal/roadway would result in better access to markets for all May Chreiy villagers.

Health care received a second priority, with 85 percent of the villages in the district having better access to health services than May Chreiy. The nearest health centre to May Chreiy is located 11 kilometres away, in Kouk Russie village, Kaev Poar Commune. Although the health centre is relatively close, the access road/canal is in such poor condition, that travel time, cost and effort required to make the trip are high and therefore the level of accessibility is relatively low. Improving this access route between Kouk Russie and May Chreiy would improve village access to health care.

Access to education is comparatively good with only 20 percent of villages in the district having better access to schooling. The education priorities are calculated using accessibility information for both primary and secondary schooling. The accessibility ranking is limited as it does not consider level of education, only that an education institution can be accessed. May Chreiy has very good access to primary schooling, with very low travel times, costs and effort associated with attendance. However, May Chreiy has poor access to secondary schooling, with only three percent of students continuing their education to the secondary level. Although the villagers of May Chreiy have excellent access to primary schooling, their access to continued education is poor.

May Chreiy has the worst access to safe drinking water of the villages in Puok District. Villagers rely on water from the Tonle Sap Lake for consumption. They use the same water for the disposal of sewage and household refuse and for cleaning clothes and utensils. Motorised vessels also contribute to the water pollution.

Access to transport infrastructure is comparatively poor, with 94 percent of villages within the district having better access to all weather roads and canals than May Chreiy. The nearest all weather road is approximately 11 kilometres from the village and access to this roadway is via a canal that is in poor condition and difficult to navigate for most of the year. Improving the existing access route between May Chreiy and the nearest all weather road will improve access to the district centre, markets, education and health care.

The accessibility rankings for drinking water, transport infrastructure, markets, education and health care can be combined to give an overall accessibility ranking. This provides a general indication of how the floating village of May Chreiy compares to the land-based villages within Puok district. It was found that 81 percent of the villages within Puok have better overall access to basic needs and services. This poor level of overall accessibility can be attributed to one major factor – the poor condition of the access route between May Chreiy and Chong Teuk.

Accessibility Recommendations

It is recommended that the access route between May Chreiy and Chong Teuk be rehabilitated. This will enable vessels to use the canal during the wet season and vehicles to use the roadway in the dry season, reliably, safely and efficiently. With the improvement of the canal/roadway, villagers of May Chreiy will have increased access to markets, health care and the hub of economic activity in the district - the district centre.

The majority of May Chreiy residents own non-motorised vessels, with few having access to motorised transportation. The non-motorised vessels have been adapted to the current poor conditions, being short with a shallow draft. The travel times associated with the use of these vessels may not be greatly reduced by the improvement of the waterway in the short-term, however, travel costs for chartered transport may decrease and increased competition from traders will reduce consumer costs at floating retail outlets. The villagers will gain maximum benefit from this investment in infrastructure if there is an effective public transport service in operation. With a reliable route in the wet and dry season and some encouragement and assistance from district authorities, a profitable public transport service could be initiated.

Access to drinking water has been identified as the most urgent accessibility problem. At least two wells need to be installed to provide safe drinking water for the villagers, one to be used in the dry season and one for the wet season. During the wet season, the only location suitable for a well is on the hill in the centre of May Chreiy. During the dry season, the village relocates to the edge of the Tonle Sap Lake and a well could be located close to the village, positioned according to water level and water quality.

Firewood is collected from forests located on the edge of the Tonle Sap. Stripping timber from 'green' tree canopies is an unsustainable practice. Education is needed to inform the villagers of the environmental consequences of such activities. Access to a sustainable source of firewood needs to be provided and a more fuel efficient use of firewood could be investigated. This could reduce the travel time and effort spent on this activity.

The study identified methods to incorporate inland water transport into the IRAP planning process. The indicators used to prioritise accessibility improvements now include villages that rely on water transport. The information used to incorporate the villages into the IRAP procedure was gathered during the wet season. It is recommended that further research is conducted during the dry season to ensure that extrapolations or assumptions are accurate.

CONCLUSION

This report marks the first stage in the study of the role of inland water transport in rural households. The objective of the study was to obtain a quantitative measure of the role of inland water transport in providing accessibility to basic needs and services and to identify methods to improve poor accessibility. A further aim was to refine the IRAP tool by reviewing the indicators used to prioritise rural development and to incorporate water transport into this procedure.

The traffic count provided a basic understanding of the types of vessels commonly used and a quantitative measure of the traffic flowing through the village. It was found that the locally made canoe, propelled by paddle, was the most common vessel used. It was also discovered that the volume of traffic was greatest in the early morning, travelling out of the village.

The Origin and Destination survey gave a more detailed profile of waterway users, the types of vessels used and the role of the waterway in satisfying the travel needs of the village. A number of comparisons were made to discover trends between age, gender, vessel type, load, ownership, travel time and travel distance. It was discovered that the average travel time was consistent, irrespective of the means of propulsion. It was also found that each vessel type had a specific role in the transportation of primary products, secondary products or retail goods.

The household survey was conducted to obtain detailed information on household needs and the transport method and trip frequency necessary to meet these. The wealth ranking provided supplementary information, used with the household survey, to compare wealth and travel times, travel modes and travel patterns. It was found that more wealthy households owned more motorised vessels and spent the majority of their time visiting markets and selling fish. Households considered less wealthy were found to spend most of their time fishing and fetching firewood.

The gender comparison found that males dominate the use of water vessels with a majority participation rate in all sectors - primary, secondary and retail, while the retail sector was found to attract the largest proportion of females. Men collected over 80 percent of the fish and firewood. Motorised vessels were more commonly used by men, with a very small proportion of women using this type of vessel.

The villagers' reliance on seafood is demonstrated by the fact that seafood is the commodity most often transported, in both volume and frequency. It is interesting to note that almost half of the vessels interviewed were travelling empty, which may demonstrate inefficiencies in inland water transport.

The age comparison found that the average age of a water transport user in May Chreiy was higher than the national average. The older members of the population tend to travel for a longer period of time when compared to younger members. Although the village appears to be quite poor, almost 90 percent of the population own their own vessels.

As part of the IRAP process, workshops were conducted to evaluate the role inland water transport plays in providing accessibility. The workshop provided information on travel

methods, effort and costs associated with collecting drinking water, firewood, visiting health centres, the district centre, markets, education institutions, travel to employment and access to public transport infrastructure and services. This information was then used to compare the current accessibility situation with other villages within the district. Through this comparison, villages within the district can be ranked according to their level of accessibility and priorities can be derived and used for future improvements.

It was found that 81 percent of the villages in Puok district have better overall access to basic needs and services then May Chreiy. The villagers of May Chreiy have excellent access to basic schooling, but poor access to markets, health care and reliable transport infrastructure and services. May Chreiy has the worst access to safe drinking water of the 154 villages in Puok district. Their only source of drinking water is the Tonle Sap Lake, which is polluted for much of the year and unfit for drinking.

It is recommended that the access route between May Chreiy and the nearest all weather road at Kouk Russie village, be rehabilitated. This route is a canal in the wet season and the top of the embankments forming the canal are wide enough to be used as a roadway during the dry season and the wet/dry season transition. Through the improvement of the canal/roadway, access to markets, health care and the road network connecting to the district centre will be increased. It is also recommended that access to drinking water be improved by the installation of two pump wells, one accessible during the wet season and one close to the dry season village location.

A sustainable source of firewood needs to be identified and access to this source provided. Alternatively, improvements could be made to fuel efficiency i.e., fuel efficient methods of cooking could be introduced. This would reduce time and energy spent on this activity and benefit the local environment.

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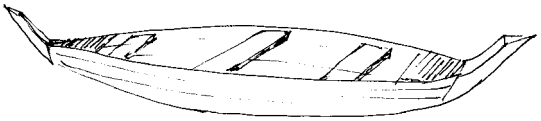
Appendices

APPENDIX 1

Diagrams of Vessel Types



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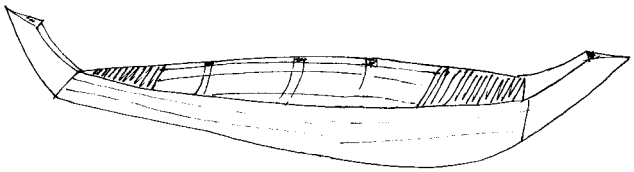

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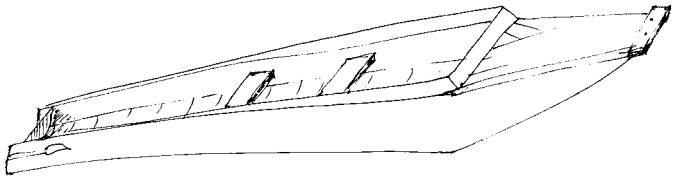
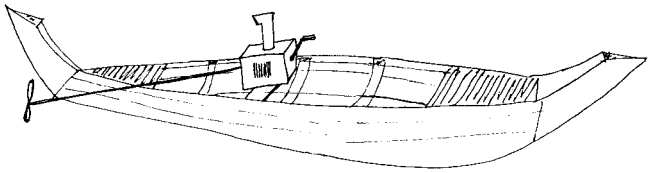


NON-MOTORISED LONGBOAT



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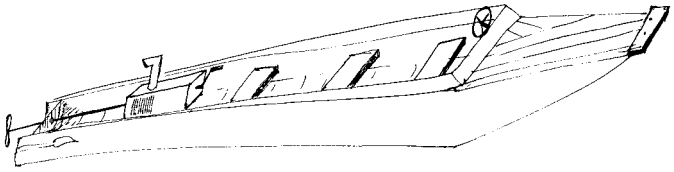

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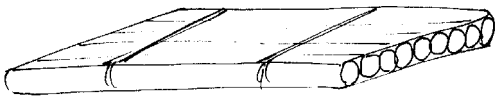
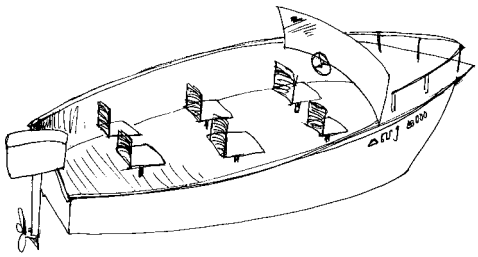


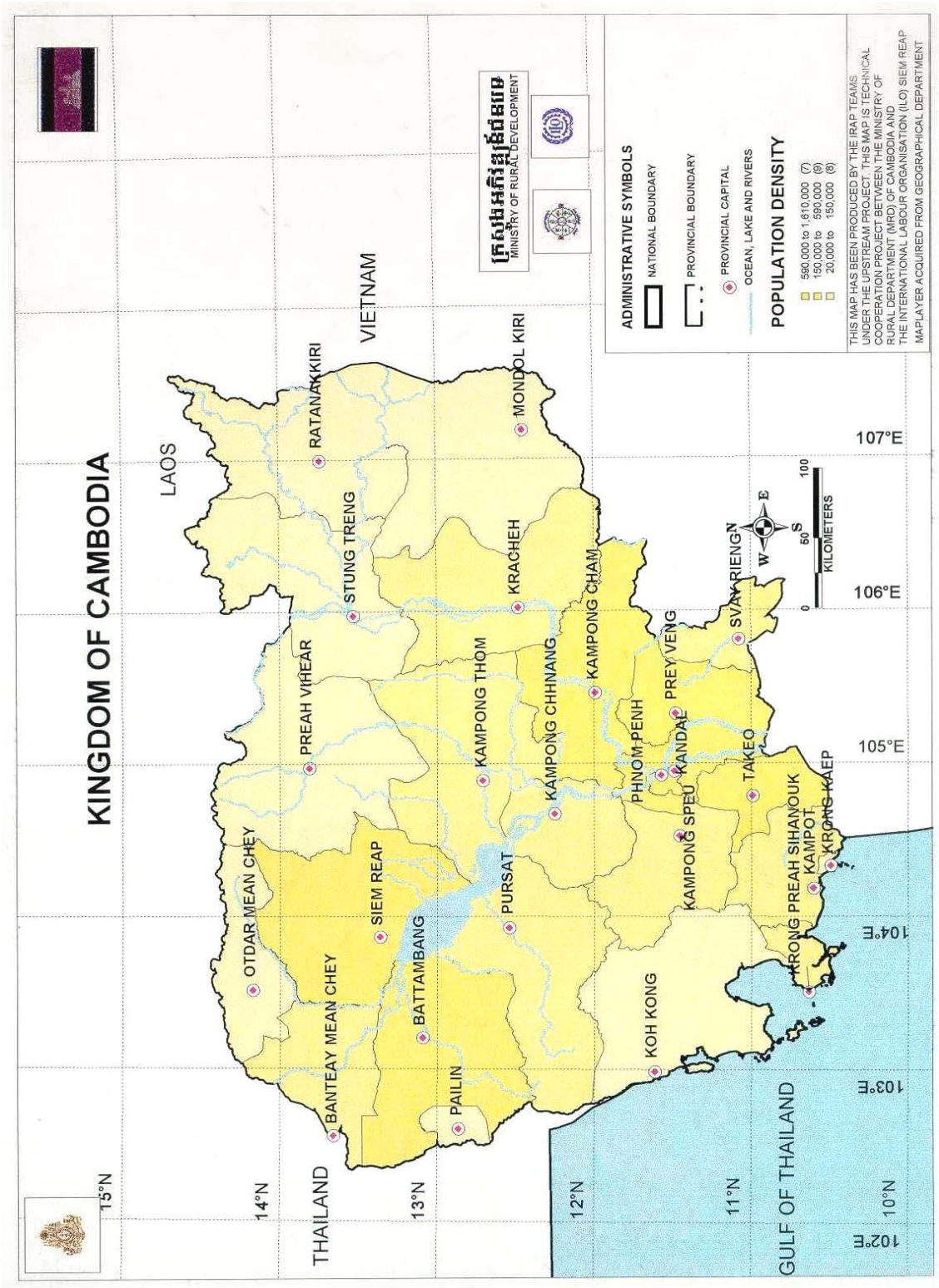
BARGE



SPEEDBOAT

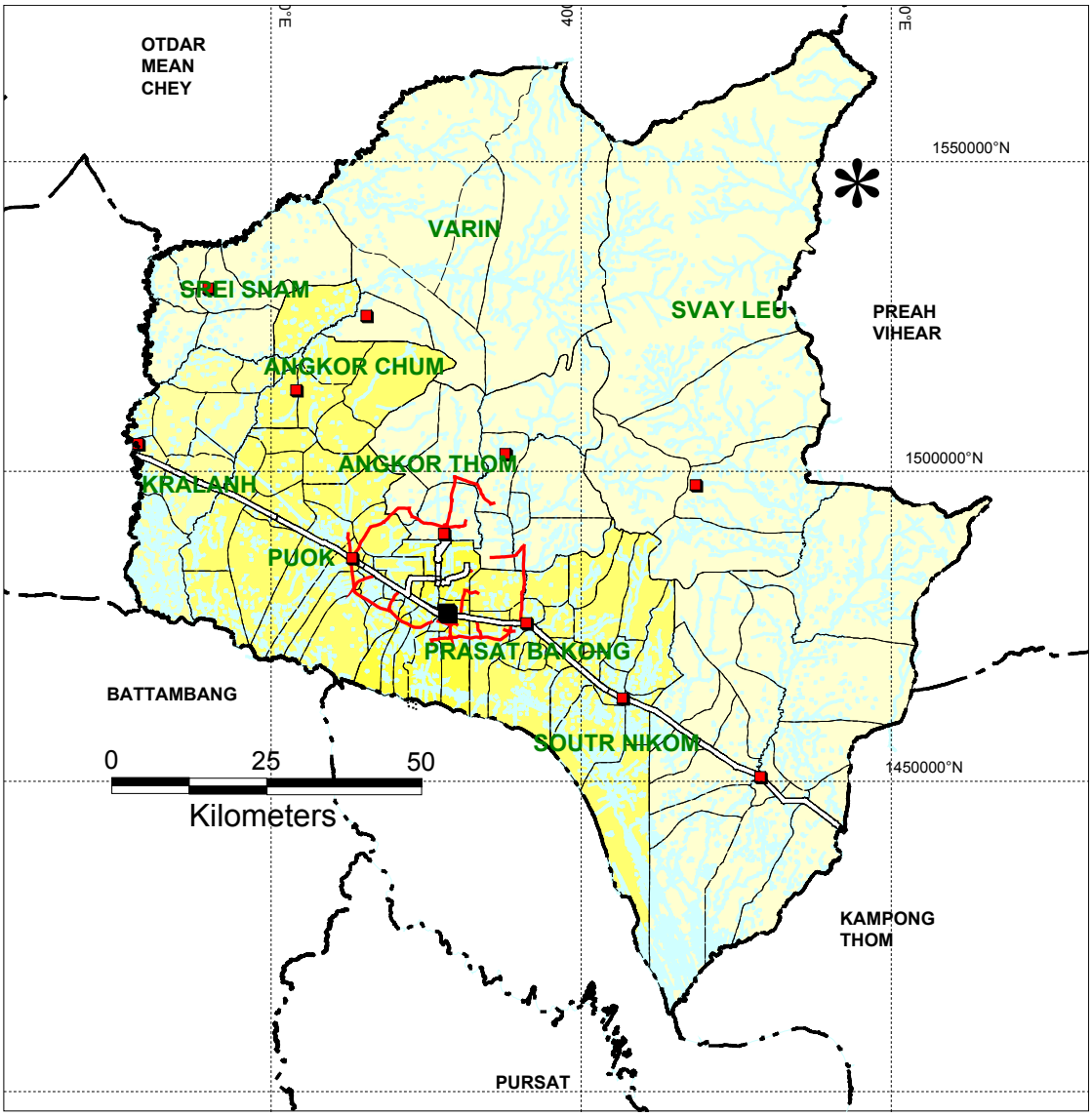
APPENDIX 2

Map of Cambodia



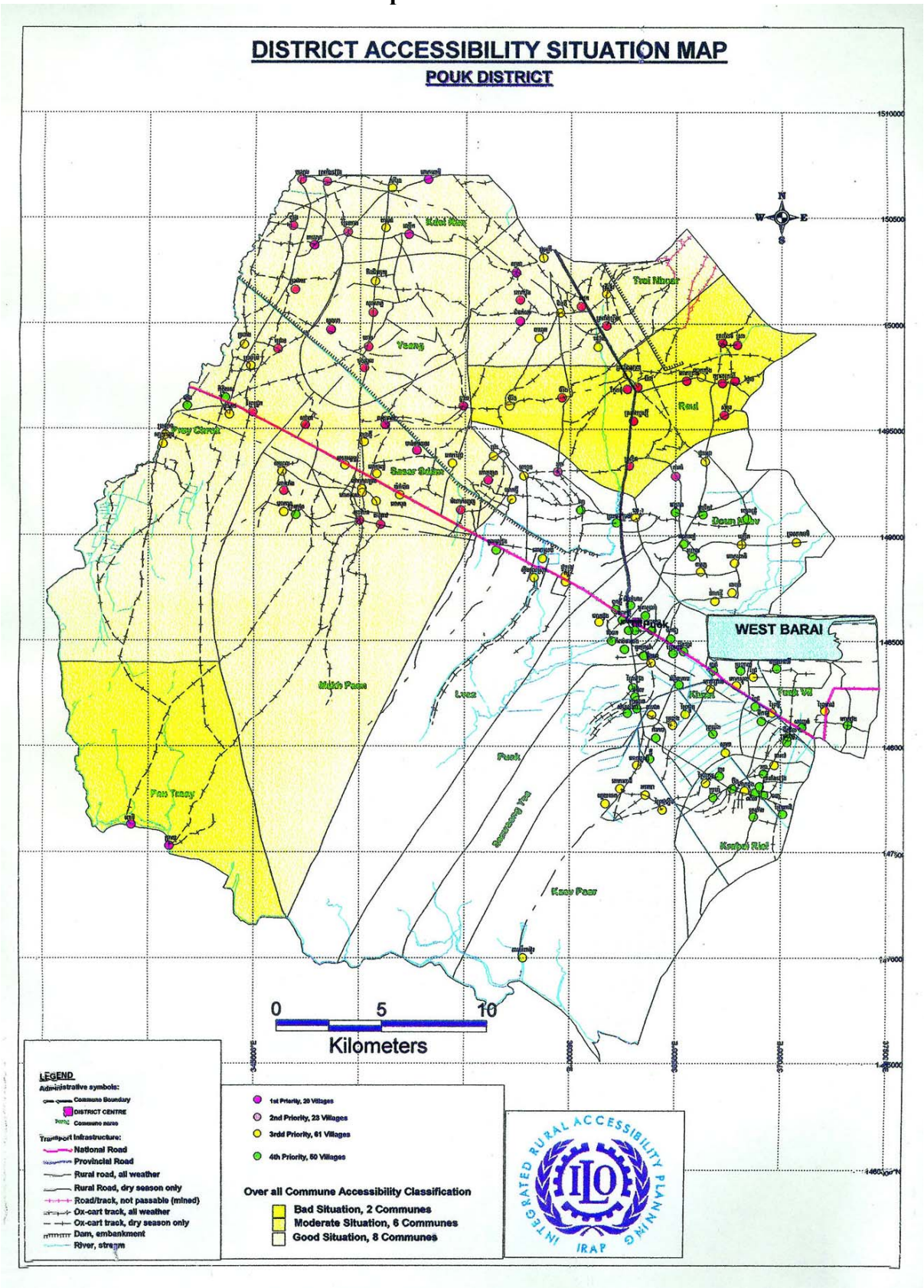
APPENDIX 3

Siem Reap Province



APPENDIX 4

Map of Puok District



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