

Small Area Analysis of Phnom Penh Metropolitan Area

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1. Objectives

To confirm whether Clark Model comprises in Phnom Penh Metropolitan Area as well as many cities all over the world or not.

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2. Basic Information on Analysis

4.1. Area Coverage

*Phnom Penh and the surrounding 6 provinces are drawn on the maps:
Kandal, Takeo, Kampong Speu, Kampong Chhnang,
Kampong Cham and Prey Veng.*

4.2. Concentric Circle

*Pink circle are concentric circles which is taken Ou Ruessey III commune
as a center downtown of Phnom Penh.*

The inner's circle's radius is 10km and the outer circle's one is 20km.

4.3. Source of data used on the maps

- (1) 2008 Population Census*
- (2) 1998 Population Census*
- (3) 2009 Nation-wide Establishment Listing*
- (4) Commune boundary data (as of 7 Sep. 2009)*

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3. Administrative Area in Cambodia

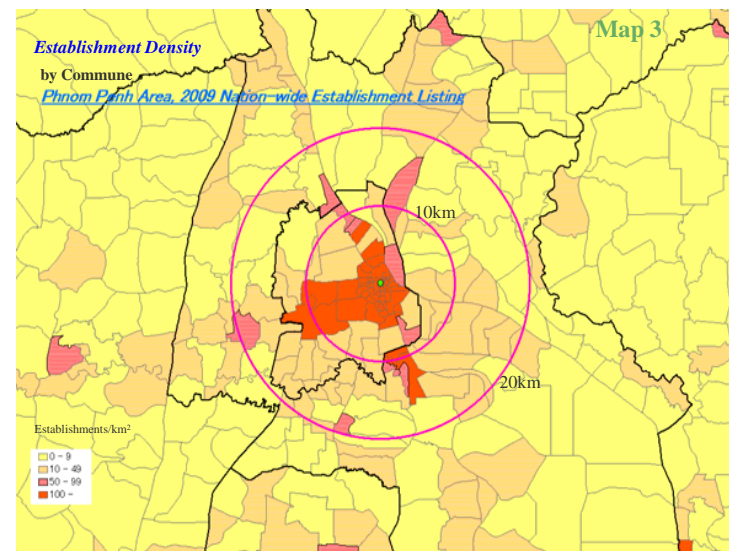
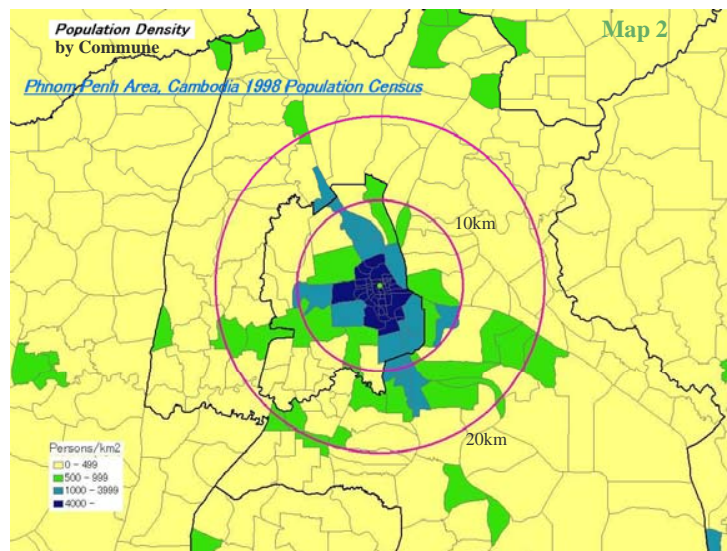
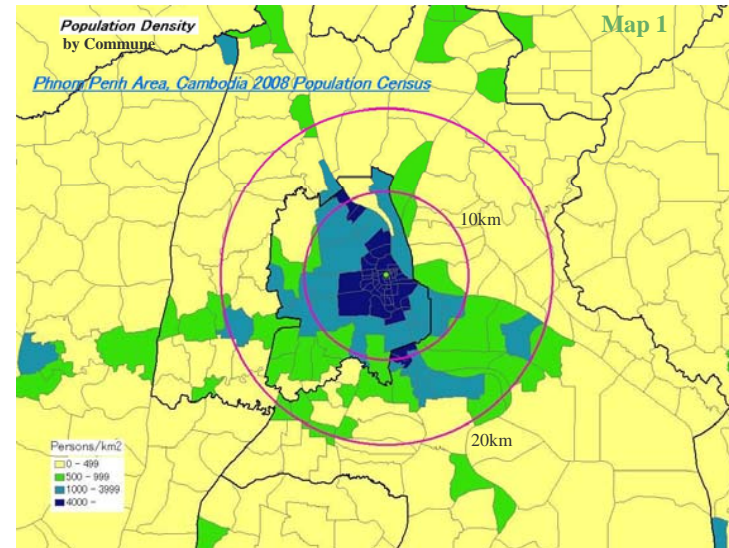
as of 7 Sep. 2009

- Provinces (24) including 1 Capital*
- Districts (193) including 8 khans and 26 municipalities*
- Communes (1,621) including 204 sangkats*
- Villages (14,073)*

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4. Outline of Phnom Penh

- Population: 1.33 millions (10% of Cambodia) in 2008 and 0.9 millions in 1998 (8.7% of Cambodia)
- Area: 294km² (0.16% of Cambodia)
(376km² under GIS)
- Population Density: 4,516 persons/km² in 2008 and 3,448 persons/km² in 1998
(3,534 persons/km² under GIS)
- Sex Ratio: 89 (females are 10% more than males.) in 2008 and 93.1 in 1998
- Number of Establishments: 56,000 (15% of Cambodia)



5. Clark Model of Population and Establishment Density

Population density in urban area declines exponentially as away from the down town, Clark Model advocated by a British Dr. Colin G. Clark in 1951.

This has already been proved in many cities all over the world.

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6. Allocation of Clark Model to Phnom Penh Metropolitan Area

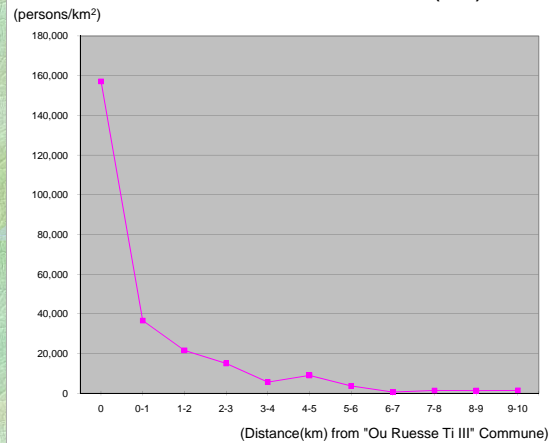
- *Center of the concentric circle: the most inhabited commune in PP*
- *Population by range of distance from the center: Assigned each commune to each range of distance by barycentric coordinates of each commune.*

- *Distance from the center*

Calculated by two coordinates of both the center and the barycenter of each commune.

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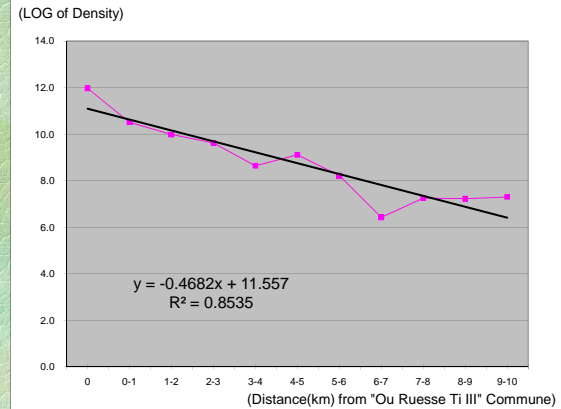
Graph 1-1. Population Density by Distance from the Most Inhabited Commune in Phnom Penh (2008)



Source: 2008 Population Census of Cambodia, F. Nishi, Japan

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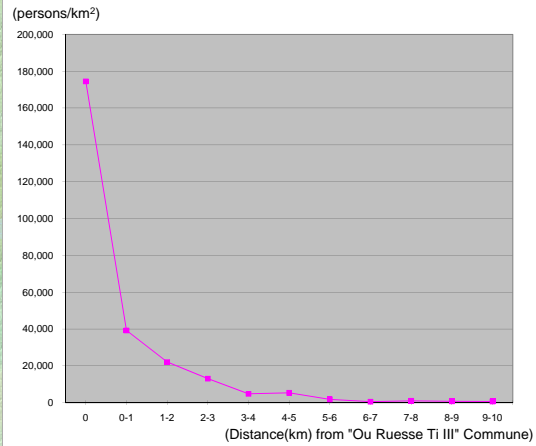
Graph 1-2. Application of Clark Model to Population Density by Distance from the Most Inhabited Commune in Phnom Penh (2008)



Source: 2008 Population Census of Cambodia, F. Nishi, Japan

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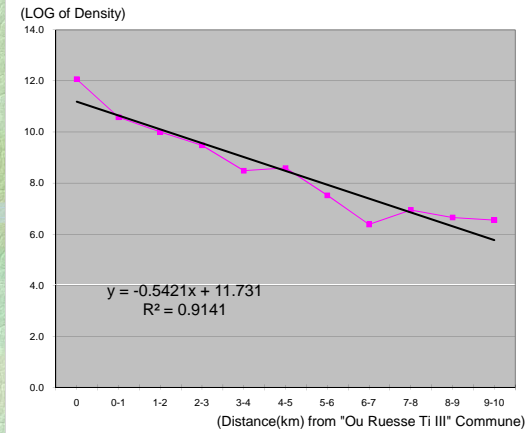
Graph 2-1. Population Density by Distance from the Most Inhabited Commune in Phnom Penh (1998)



Source: 1998 Population Census of Cambodia, F. Nishi, Japan

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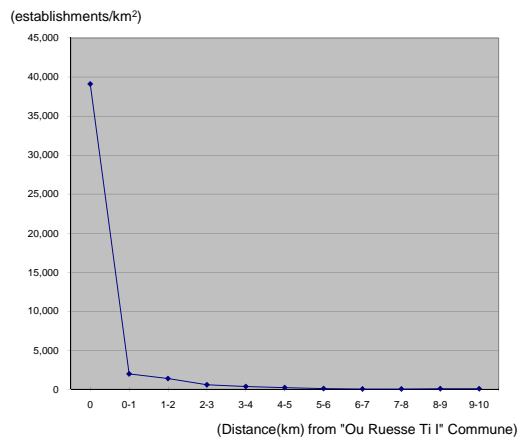
Graph 2-2. Application of Clark Model to Population Density by Distance from the Most Inhabited Commune in Phnom Penh (1998)



Source: 1998 Population Census of Cambodia, F. Nishi, Japan

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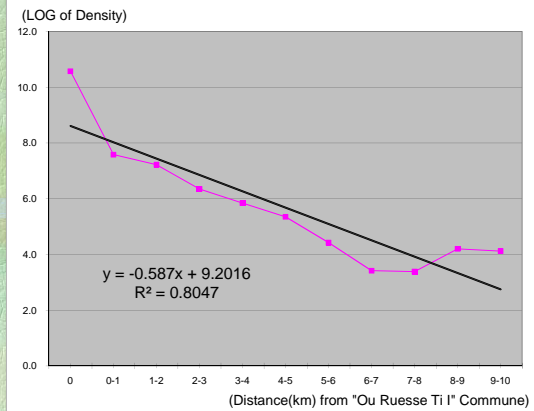
Graph 3-1. Establishment Density by Distance from the Most Dense Commune in Phnom Penh (2009)



Source: 2009 Nation-wide Establishment Listing of Cambodia, F. Nishi, Japan

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Graph 3-2. Application of Clark Model to Establishment Density by Distance from the Most Dense Commune in Phnom Penh (2009)



Source: 2009 Nation-wide Establishment Listing of Cambodia, F. Nishi, Japan

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Results of Allocation of Clark Model to Phnom Penh Metropolitan Area

- *Regarding population density in 2008, Graph 1-2 shows that the distribution of the logarithm of the population density by range of distance is rectilinear because R^2 is 0.85. It means that the distribution of the population density by range of distance on Graph 1-1 is exponentially. Therefore, it has been confirmed that Clark Model is allocated in PP as well. Also 1998 has been proved as Graph 2-1 and 2-2.*
- *It has been confirmed that Phnom Penh Metropolitan Area is extending. Because the slope of regression equation on Graph 1-2 and 2-2 which is one of indicators showing the level of development of a city is becoming more even.*

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(Cont.)

- *Regarding establishment density in 2009, Graph 3-2 shows $R^2=0.80$. It means that the allocation to Clark Model of establishment is worse than that of population.*

However, government offices, mobile establishments, and so on are not included in the above mentioned establishment.

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THE END

<http://www.stat.go.jp/english/info/meetings/cambodia/phase2.htm>