

An Analysis of Vehicle Kilometers of Travel of Major Cities in Thailand

Proposed for ATRANS Research Grant

August 2010

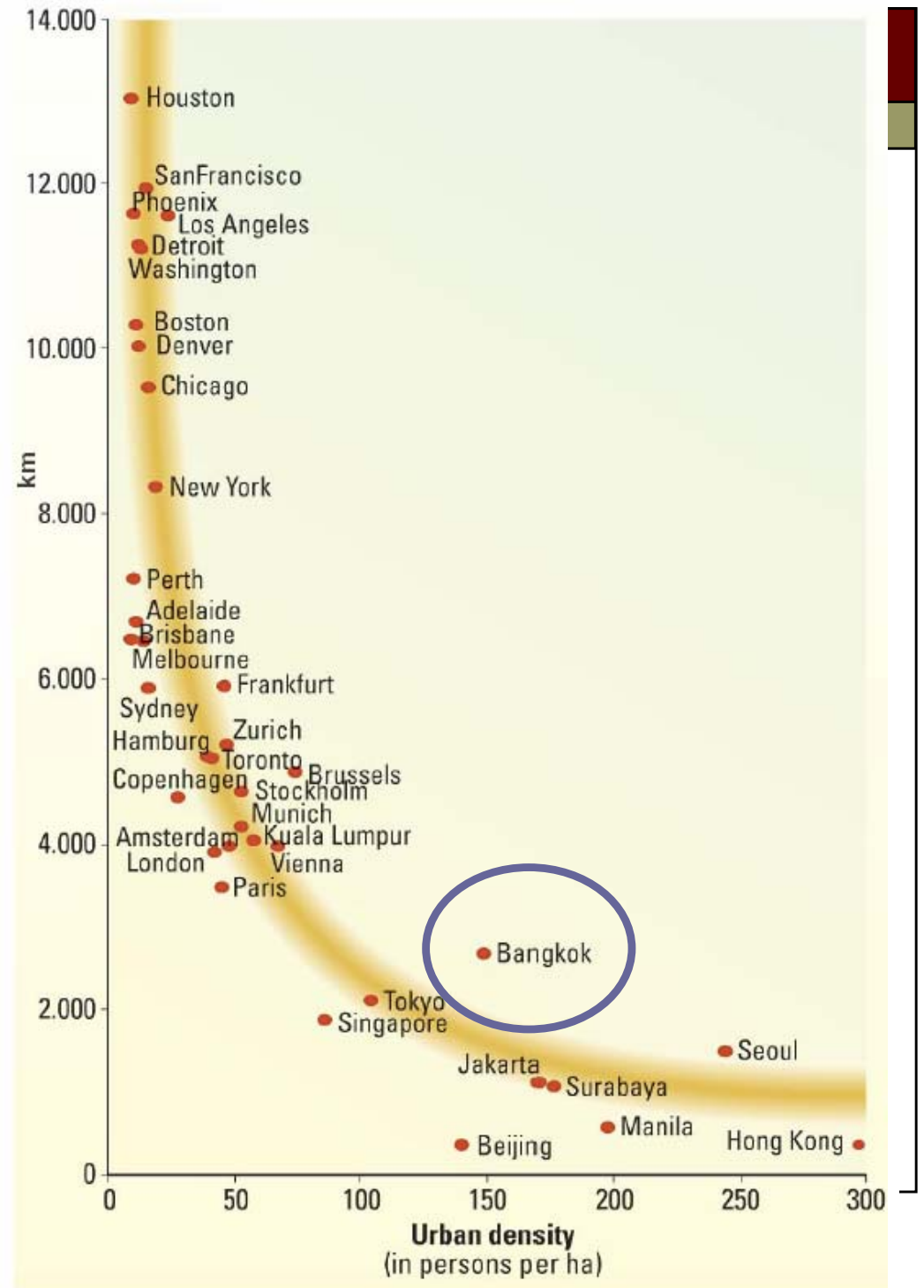
Vehicle kilometers of travel

- ❑ the amount of travel by motorized vehicles
- ❑ a single parameter that describes the overall travel behavior of a person or a group of person
- ❑ direct relationship with gasoline consumption, air pollution, GHG emission
- ❑ useful for energy planning and environment planning



Available Info

VKT/capita in 1990



Study objectives

- ❑ Aim to analyze the amount of travel by motorized vehicles, using odometer reading survey.
- ❑ Estimate the overall travel demand of Bangkok Metropolis and Nakhon Ratchasima

Research Methodology

Data collection

- Department of Land Transport
- Gas Station
- ■ Shopping Mall
- Bus Terminal



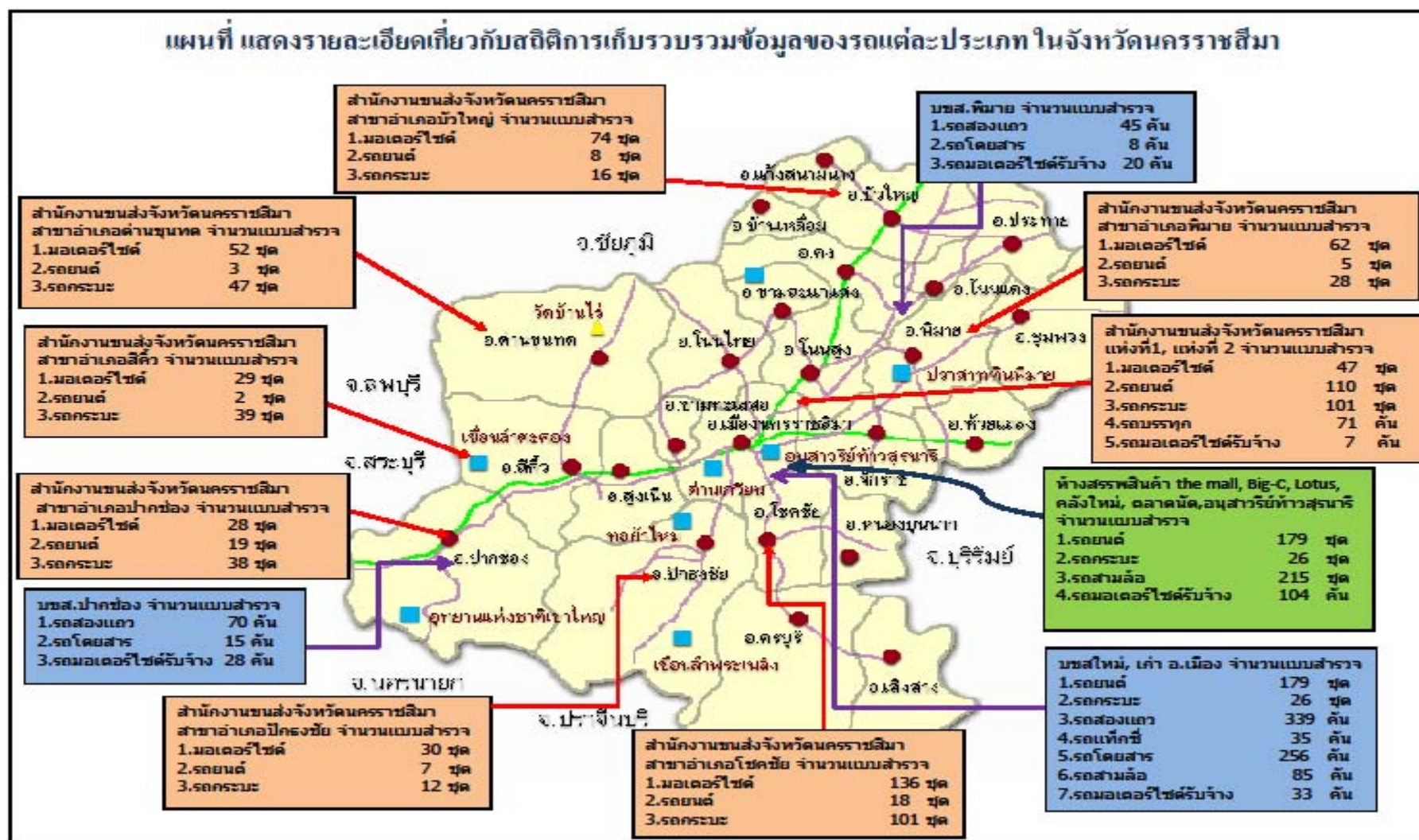
Research Methodology

❑ Vehicle Classification

- ❑ Sedan Not more than 7 pass.
- ❑ Microbus&Passenger Pick Up
- ❑ Van & Pick up
- ❑ Motorcycle
- ❑ Urban Taxi
- ❑ Motortricycle&Motortricycle taxi,tuk tuk
- ❑ Motorcycle Taxi
- ❑ Fixed Route Bus
- ❑ Non Fixed Route Truck



Map collection data

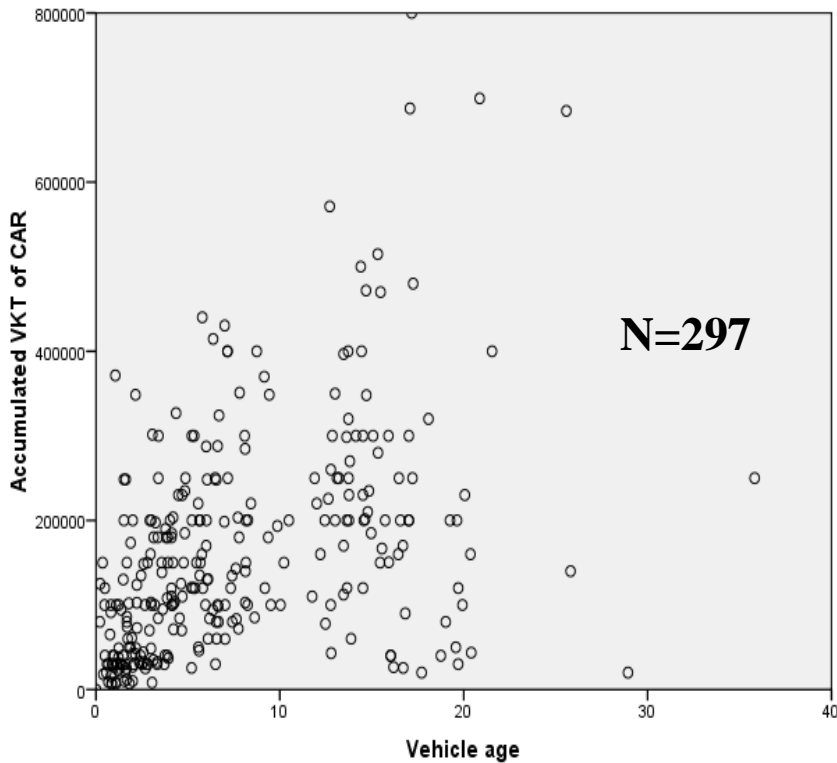


Result Regression Analysis Nakhon Ratchasima

Independent :year

1. Sedan Not more than 7 pass.

Observed Data



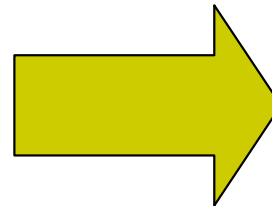
$$VKT_{avg,i} = \frac{\sum_{n=1}^N VKT_{obs,i}}{N_i}$$

Where $VKT_{avg,i}$ is average vehicle kilometer of travel of vehicle age i , $VKT_{obs,i}$ is observed vehicle kilometer of travel of vehicle age i , and N is total number of observation data

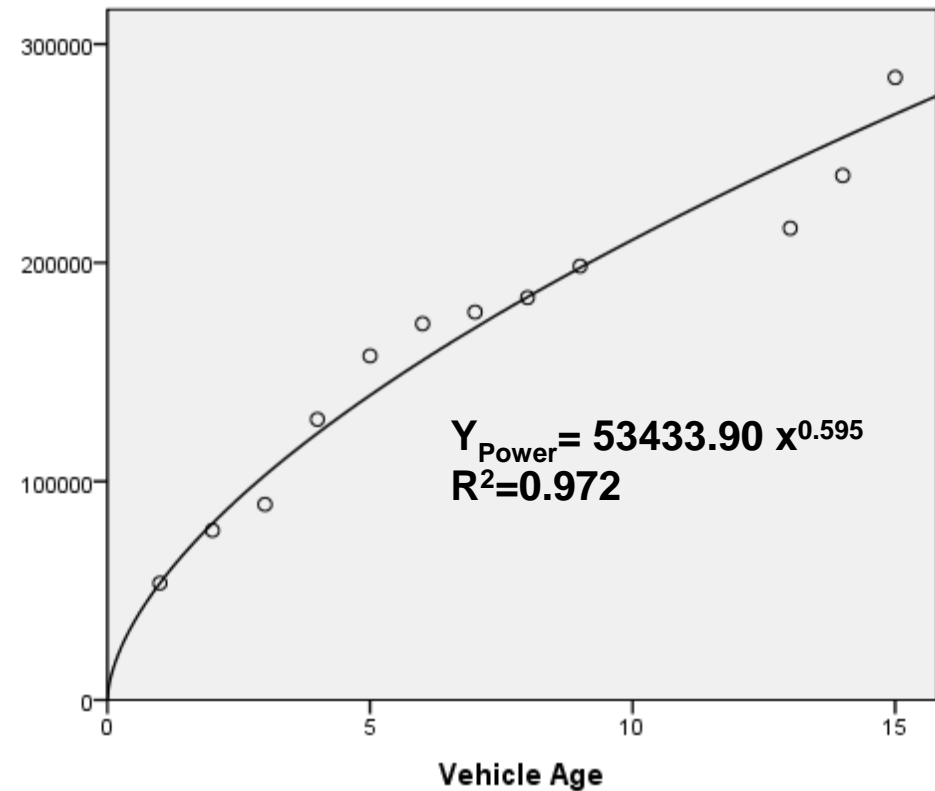
Vehicle Age	Accumulated VKT CAR	N
1	53421	22
2	77578	40
3	89441	24
4	128377	26
5	157391	23
6	172103	21
7	177436	20
8	184056	14
9	198459	12
13	215766	10
14	239873	17
15	284728	13
Total		242

1. Sedan Not more than 7 pass. (Cont'd)

Vehicle Age	Average Accumulated VKT	N
1	53421	22
2	77578	40
3	89441	24
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6	172103	21
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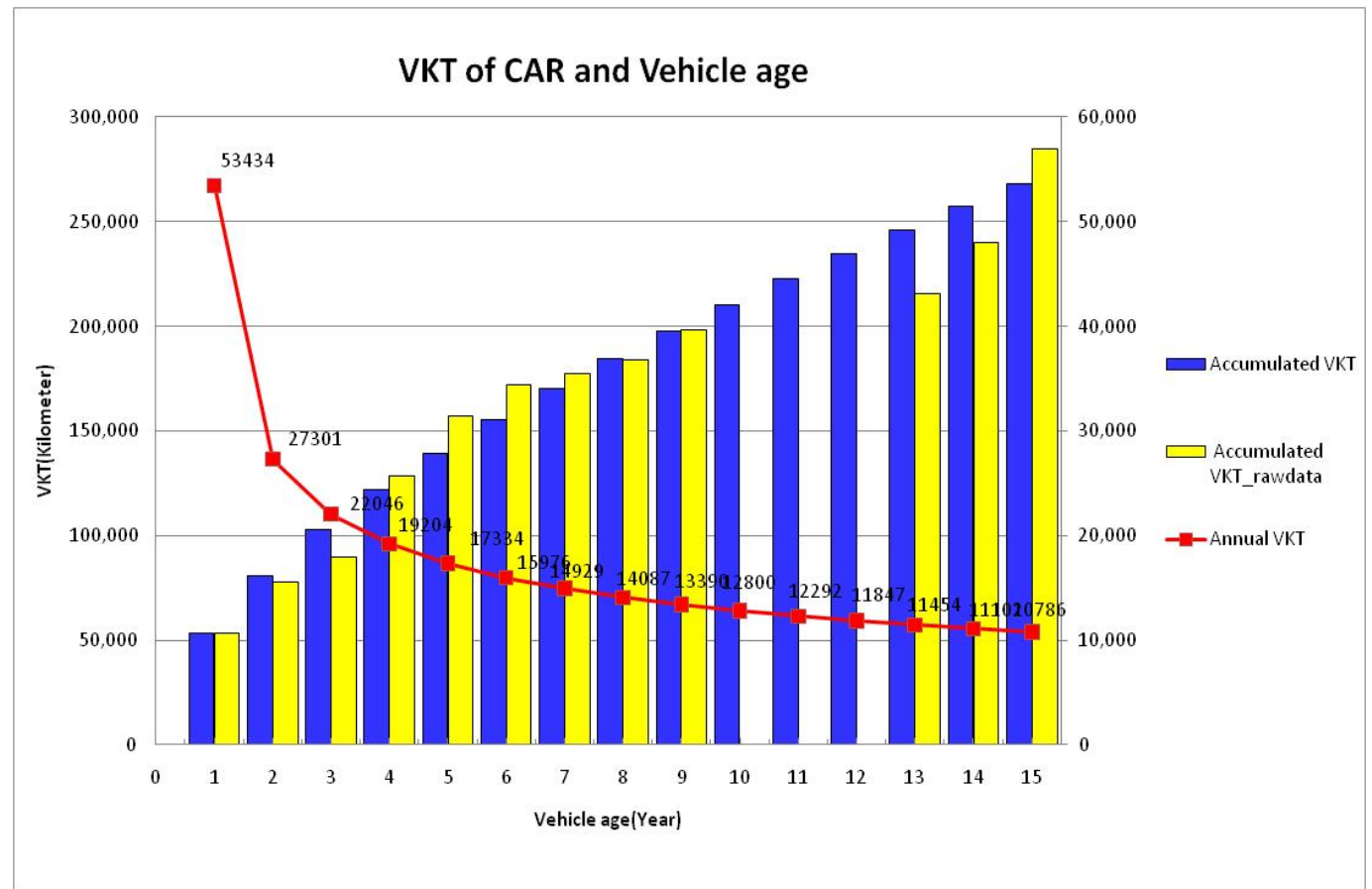
Average Accumulated VKT of Car



1. Sedan Not more than 7 pass. (Cont'd)

$$VKT_{ann,i} = VKT_{avg,i} - VKT_{avg,i-1}$$

Where $VKT_{avg,i}$ is average vehicle kilometer of travel of vehicle age i , $VKT_{ann,i}$ is observed vehicle kilometer of travel of vehicle age i and $VKT_{ann,i-1}$ is observed vehicle kilometer of travel of vehicle age $i-1$



Summary

Type of vehicle	Motorcycle	Motorcycle Taxi	TUK TUK	PICK UP	TAXI	CAR	BUS	TRUCK	Songteaw
Year/Equation	$5587.6960x^{1.005}$	$14657.56x^{0.823}$	$17471.48x^{1.235}$	$76386.16x^{0.515}$	$91484.28x^{1.423}$	$53433.9x^{0.595}$	$111552.9x-4655.13x^2$	$80198.59-635.31x^2-5.543x^3$	$94509.91x^{0.743}$
R²	0.991	0.963	0.999	0.976	0.988	0.972	0.949	0.879	0.98
1	5588	14658	17471	76386	91484	53434	106898	79558	94510
2	5630	11265	23645	32735	153792	27301	97588	78254	63667
3	5646	10262	26716	25315	191441	22046	88277	76917	55609
4	5657	9661	28928	21449	220888	19204	78967	75546	50947
5	5664	9237	30693	18967	245732	17334	69657	74143	47740
6	5671	8913	32177	17198	267537	15976	60346	72706	45330
7	5676	8652	33466	15854	287144	14929	51036	71236	43420
8	5680	8434	34611	14787	305073	14087	41726	69733	41848
9	5684	8249	35644	13914	321665	13390	32416	68196	40522
10	5687	8087	36588	13181	337163	12800	23105	66626	39378
11	5691	7945	37458	12555	351744	12292	13795	65023	38377
12	5693	7818	38267	12012	365543	11847	4485	63387	37490
13	5696	7703	39023	11536	378664	11454	4485	61718	36694
14	5698	7598	39735	11112	391192	11102	4485	60015	35975
15	5701	7502	40407	10733	403195	10786	4485	58279	35320
11-15 ปี	5696	7713	38978	11590	378067	11496	6347	61684	36771
16-20 ปี	5701	7502	40407	10733	403195	10786	4485	58279	36694
> 20 ปี	5701	7502	40407	10733	403195	10786	4485	58279	36694
N ของข้อมูลทั้งหมด	191	141	281	218	35	297	196	70	281
N ที่ใช้วิเคราะห์	140	86	260	160	29	242	97	70	204

Summary

Type of vehicle	Motorcycle			Motorcycle Taxi			TUK TUK		
Vehicle Age	Annual VKT	Number of car*	Total VKT	Annual VKT	Number of car	Total VKT	Annual VKT	Number of car	Total VKT
1 ปี	5588	51075	285391576	14658	23	337124	17471	0	0
2 ปี	5630	48090	270746015	11265	30	337957	23645	1	23645
3 ปี	5646	58222	328724845	10262	102	1046759	26716	0	0
4 ปี	5657	63253	357792006	9661	289	2791999	28928	0	0
5 ปี	5664	60254	341297669	9237	316	2918881	30693	0	0
6 ปี	5671	50298	285216508	8913	282	2513354	32177	0	0
7 ปี	5676	36440	206822875	8652	249	2154250	33466	0	0
8 ปี	5680	22297	126650196	8434	171	1442261	34611	0	0
9 ปี	5684	17835	101374596	8249	97	800130	35644	0	0
10 ปี	5687	11329	64433406	8087	48	388194	36588	0	0
11-15 ปี	5696	79139	450759341	7713	301	2321660	38978	2	77956
16-20 ปี	5701	29034	165511321	7502	81	607695	40407	14	565697
> 20 ปี	5701	10234	58339976	7502	52	390125	40407	784	31679016
Total VKT		537,500	3,043,060,329		2,041	18,050,389		801	32,346,313

Total VKT In Nakhon Ratchasima

Type of vehicle	Motorcycle	Motorcycle Taxi	TUK TUK	PICK UP	TAXI	CAR	BUS	TRUCK	S0ngteaw
Vehicle Age	Total VKT	Total VKT	Total VKT	Total VKT	Total VKT	Total VKT	Total VKT	Total VKT	Total VKT
1	298817739	357891	0	397806038	1418941	279092663	10704787	20287221	15275455
2 ปี	275693823	393410	24144	423603286	5812811	228841292	10478714	19015685	16759482
3 ปี	326926822	1111087	0	334714577	0	178398136	12233715	27920764	11615417
4 ปี	347732188	2571685	0	264316306	0	143350949	13340248	14882622	13352872
5 ปี	324153623	2253180	0	209691990	0	116630076	10933565	26172352	8063844
6 ปี	264672630	1575892	0	142396462	0	76738143	7713473	38897560	7659264
7 ปี	187461759	1063833	0	76336602	0	42720709	4626723	15529347	5483557
8 ปี	112080324	544254	0	39446433	0	28745833	4486601	9692761	4744057
9 ปี	87552092	224974	0	31670317	0	17691779	1611452	10843068	2652808
10 ปี	54280739	80739	0	29585156	0	13954539	983888	4130777	1371905
11-15 ปี	351236506	407462	85799	699595545	0	245030090	21611454	33185310	6933171
16-20 ปี	122025021	152991	602050	692241285	0	255793107	23866320	20047196	1464708
> 20 ปี	43011782	98216	33714820	311354002	0	179241215	27873395	18939938	1196952
Total VKT	2,795,645,048	10,835,614	34,426,814	3,652,758,000	7,231,752	1,371,194,210	98,724,620	220,557,467	96,573,493

VKT In Nakhon Ratchasima

Population/Type of VKT	Total VKT	VKT of Business Vehicle*	VKT of Personal Vehicle**
Total population	3091.06 km/person	1209.37 km/person	1881.69 km/person
population Age 15-59	4615.59 Km/person	1805.84 km/person	2809.75 km/person

*Business Vehicle = Pickup, Truck

**Personal Vehicle = Car, Motorcycle, Motorcycle taxi, Taxi, Songteaw, Bus

Population: Statistics report Nakhon Ratchasima province, as of December 2552.

Result Regression Analysis Bangkok

Independent :year

Summary

Type of vehicle	Motorcycle	Motorcycle Taxi	TUK TUK	PICK UP	TAXI	CAR	BUS	TRUCK	Songteaw
Year/Equation	$4977.63x^{0.898}$	$6110.998x^{0.849}$	$45101.78x^{0.966}$	$57301.21x^{0.776}$	$136810.682x^{0.892}$	$50958.33x^{0.879}$	$156788.83x^{0.628}$	$132967.169x^{0.615}$	$156545.64x^{0.643}$
R²	0.995	0.993	0.999	0.978	0.953	0.919	0.96	0.961	0.994
1	4,978	6,111	45,102	57,301	136,811	50,958	156,789	132,967	156,545.64
2	4,298	4,896	43,001	40,820	117,075	42,759	85,516	70,680	87,911.80
3	4,074	4,523	42,242	36,282	110,626	40,128	70,265	57,674	72,813.24
4	3,935	4,297	41,757	33,617	106,636	38,510	61,893	50,576	64,467.46
5	3,835	4,136	41,399	31,765	103,764	37,350	56,330	45,879	58,896.56
6	3,757	4,012	41,117	30,363	101,531	36,450	52,260	42,452	54,806.63
7	3,693	3,912	40,883	29,245	99,711	35,719	49,101	39,799	51,623.78
8	3,640	3,828	40,685	28,320	98,179	35,105	46,550	37,661	49,046.86
9	3,594	3,756	40,512	27,536	96,858	34,576	44,428	35,886	46,899.79
10	3,553	3,693	40,359	26,858	95,701	34,114	42,625	34,380	45,071.48
11	3,517	3,638	40,221	26,262	94,671	33,703	41,065	33,079	43,487.75
12	3,484	3,588	40,097	25,732	93,745	33,333	39,698	31,939	42,096.81
13	3,455	3,543	39,983	25,255	92,904	32,998	38,484	30,929	40,861.21
14	3,428	3,502	39,879	24,823	92,134	32,692	37,397	30,026	39,753.09
15	3,403	3,465	39,782	24,429	91,426	32,411	36,416	29,210	38,751.21
11-15 ปี	3457	3547	39993	25300	92976	33028	38612	31037	40990
16-20 ปี	3403	3465	39782	24429	91426	32411	36416	29210	38751
> 20 ปี	3403	3465	39782	24429	91426	32411	36416	29210	38751
N ของข้อมูลทั้งหมด	454	263	445	284	430	348	385	475	334
N ที่ใช้วิเคราะห์	412	219	411	227	424	298	281	306	277

Summary

Type of vehicle	Motorcycle			Motorcycle Taxi			TUK TUK		
Vehicle Age	Annual VKT	Number of car*	Total VKT	Annual VKT	Number of car	Total VKT	Annual VKT	Number of car	Total VKT
1 ปี	4978	294666	1466738322	6111	3133	19145757	45102	61	2751209
2 ปี	4298	291528	1253013064	4896	3537	17318741	43001	831	35733670
3 ปี	4074	305526	1244763628	4523	6401	28952668	42242	910	38440170
4 ปี	3935	256909	1010998363	4297	11922	51223958	41757	38	1586749
5 ปี	3835	211654	811705694	4136	11823	48895441	41399	52	2152764
6 ปี	3757	147648	554723978	4012	9224	37003995	41117	14	575636
7 ปี	3693	123519	456208934	3912	8645	33815008	40883	6	245300
8 ปี	3640	69089	251470947	3828	4486	17171208	40685	36	1464646
9 ปี	3594	49080	176372534	3756	2570	9652822	40512	7	283581
10 ปี	3553	35380	125704703	3693	1160	4284266	40359	5	201793
11-15 ปี	3457	159520	551517016	3547	2161	7665687	39993	48	1919642
16-20 ปี	3403	97139	330554229	3465	698	2418375	39782	357	14202197
> 20 ปี	3403	61352	208774674	3465	122	422696	39782	7256	288658664
Total VKT		2,103,010	8,442,546,086		6,882	277,970,619		9621	388,216,020

Total VKT In BANGKOK

Type of vehicle	Motorcycle	Motorcycle Taxi	TUK TUK	PICK UP	TAXI	CAR	BUS	TRUCK	Songteaw
Vehicle Age	Total VKT	Total VKT	Total VKT	Total VKT	Total VKT	Total VKT	Total VKT	Total VKT	Total VKT
1 ปี	1466738322	19145756.73	2751208.58	3849839095.06	1691800868.88	8946804956	352304501	450758702.91	1565926036.92
2 ปี	1253013064	17318740.55	35733670.11	3716746226.05	939880689.35	7625536644	106381824.4	276711268.36	1164655557.89
3 ปี	1244763628	28952667.8	38440169.73	3191222803.53	1202065102.92	6586504782	78134919.8	177404848.52	737962191.66
4 ปี	1010998363	51223957.62	1586749.43	3268201079.31	1447369046.02	6797014976	45553186.32	167913239.12	612376357.46
5 ปี	811705693.9	48895441.06	2152764.20	2473589855.03	851588313.00	6114331533	36726996.51	222282424.06	403323617.13
6 ปี	554723978.4	37003994.52	575635.54	1954059502.46	764424775.62	5416191833	49437579.29	166497385.93	391648199.17
7 ปี	456208933.6	33815008.01	245300.31	1466165317.53	808553687.82	4268282136	62554633.32	89747696.03	343762755.75
8 ปี	251470946.9	17171207.76	1464645.60	913561024.49	543123958.76	3090162003	64517815.63	60182405.07	288787887.18
9 ปี	176372534.1	9652821.52	283581.19	853044758.69	454556811.42	2287048649	30655471.6	55336456.10	216817718.40
10 ปี	125704703	4284266.086	201792.61	784731229.25	194463646.20	1838924223	22633855.51	31766907.78	154775474.26
11-15 ปี	551517015.7	7665686.54	1919641.64	4084778336.91	167356287.52	11810471426	79193438.9	293079668.69	1222076279.55
16-20 ปี	330554229.1	2418375.032	14202197.23	1921987152.06	59426584.65	7800672044	110813268.4	196732617.41	1529704076.35
> 20 ปี	208774674.1	422695.9225	288658664.15	843161108.75	32638908.80	4295796818	115583737.7	105917219.11	1464989553.04
Total VKT	8,442,546,086	277,970,619	388,216,020	2,932,108,489	9,157,248,681	64,781,273,162	928,094,222	1,991,681,003	10,096,805,705

VKT In Bangkok

Population/Type of VKT	Total VKT	VKT of Business Vehicle*	VKT of Personal Vehicle**
Total population	21,987.34 km/person	5490.97 km/person	16,496.38 km/person
population Age 15-59	32,533.76 Km/person	8124.76 km/person	24,409 km/person

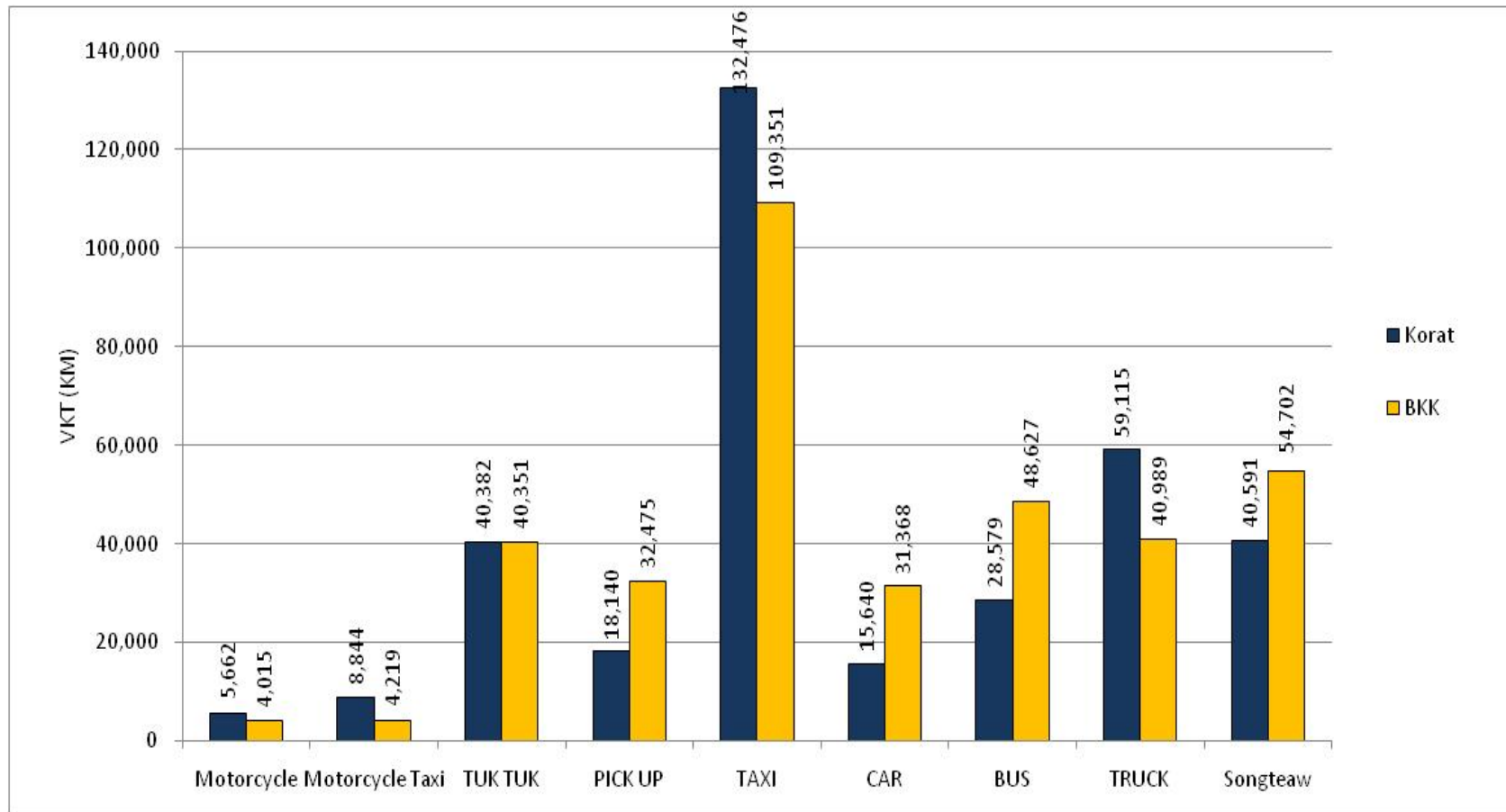
*Business Vehicle = Pickup, Truck

**Personal Vehicle = Car, Motorcycle, Motorcycle taxi, Taxi, Songteaw, Bus

ตารางแสดงอัตราส่วนยานพาหนะต่อบุคคลในกทม และเขตปริมณฑล

รายละเอียด	นครปฐม	สมุทรสาคร	ปทุมธานี	นนทบุรี	สมุทรปราการ	กทม
จำนวนรถที่จดทะเบียน (สถิติปี 2552)	356,393	171,587	120,534	156,978	125,073	6,103,719
จำนวนประชากร (สถิติปี 2552)	851,426	484,606	956,376	1,078,071	1,164,105	5,702,595
รถทุกประเภท / ประชากร	0.419	0.354	0.126	0.146	0.107	1.070
รถยนต์(สถิติปี 2552)	36,762	5,626	26,525	58,274	17,449	2,383,061
รถจักรยานยนต์ (สถิติปี 2552)	77,476	10,785	28,775	38,737	18,889	960,645
รถมอเตอร์ไซด์ (สถิติปี 2552)	209,280	140,133	42,581	41,708	41,374	2,390,366
รถยนต์ / ประชากร	0.043	0.012	0.028	0.054	0.015	0.418
รถจักรยานยนต์ / ประชากร	0.091	0.022	0.030	0.036	0.016	0.168
รถมอเตอร์ไซด์ / ประชากร	0.246	0.289	0.045	0.039	0.036	0.419
รถยนต์+รถจักรยานยนต์+รถมอเตอร์ไซด์ / ประชากร	0.38	0.32	0.10	0.13	0.07	1.01

Compare Average VKT

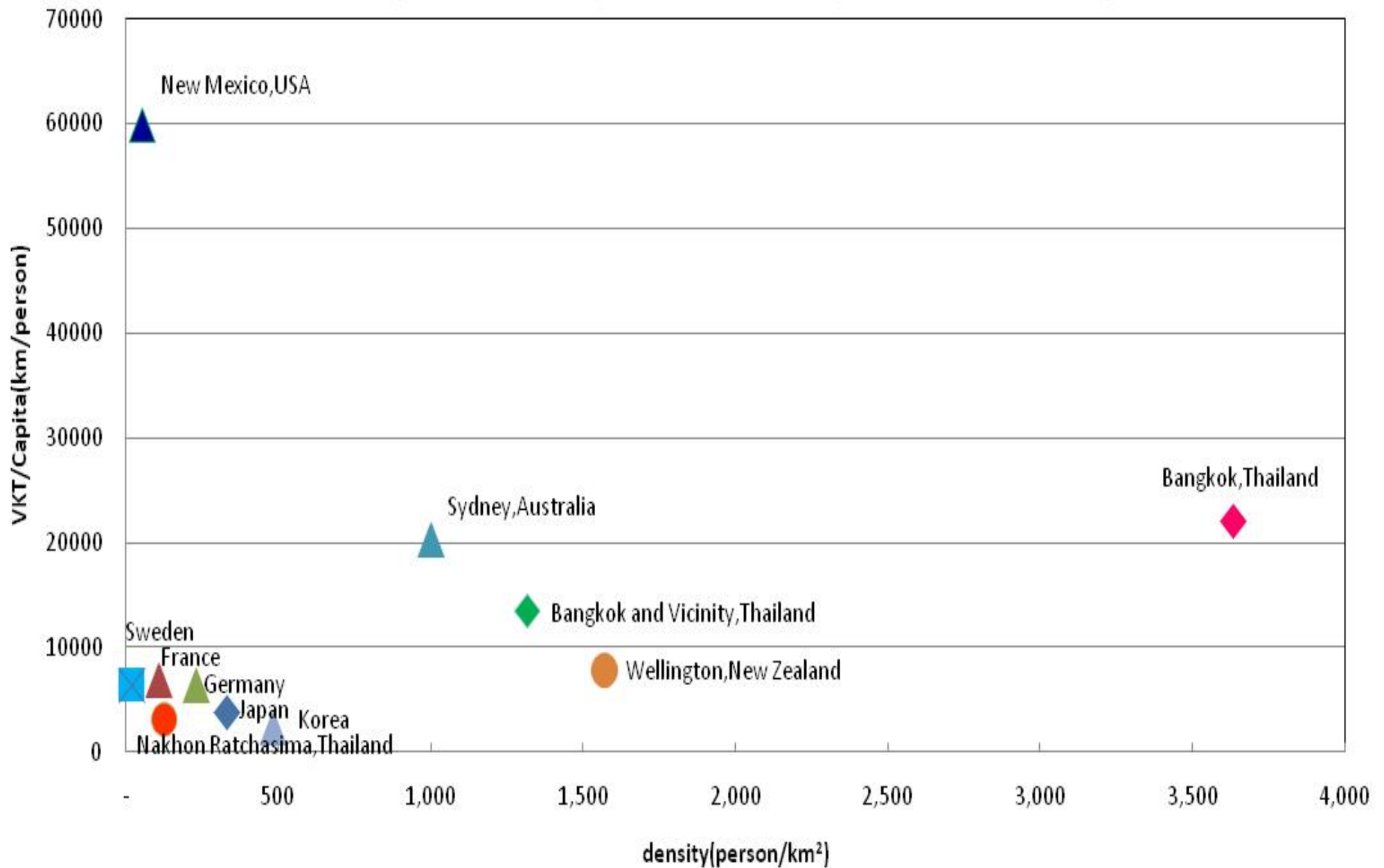


Vehicle Type

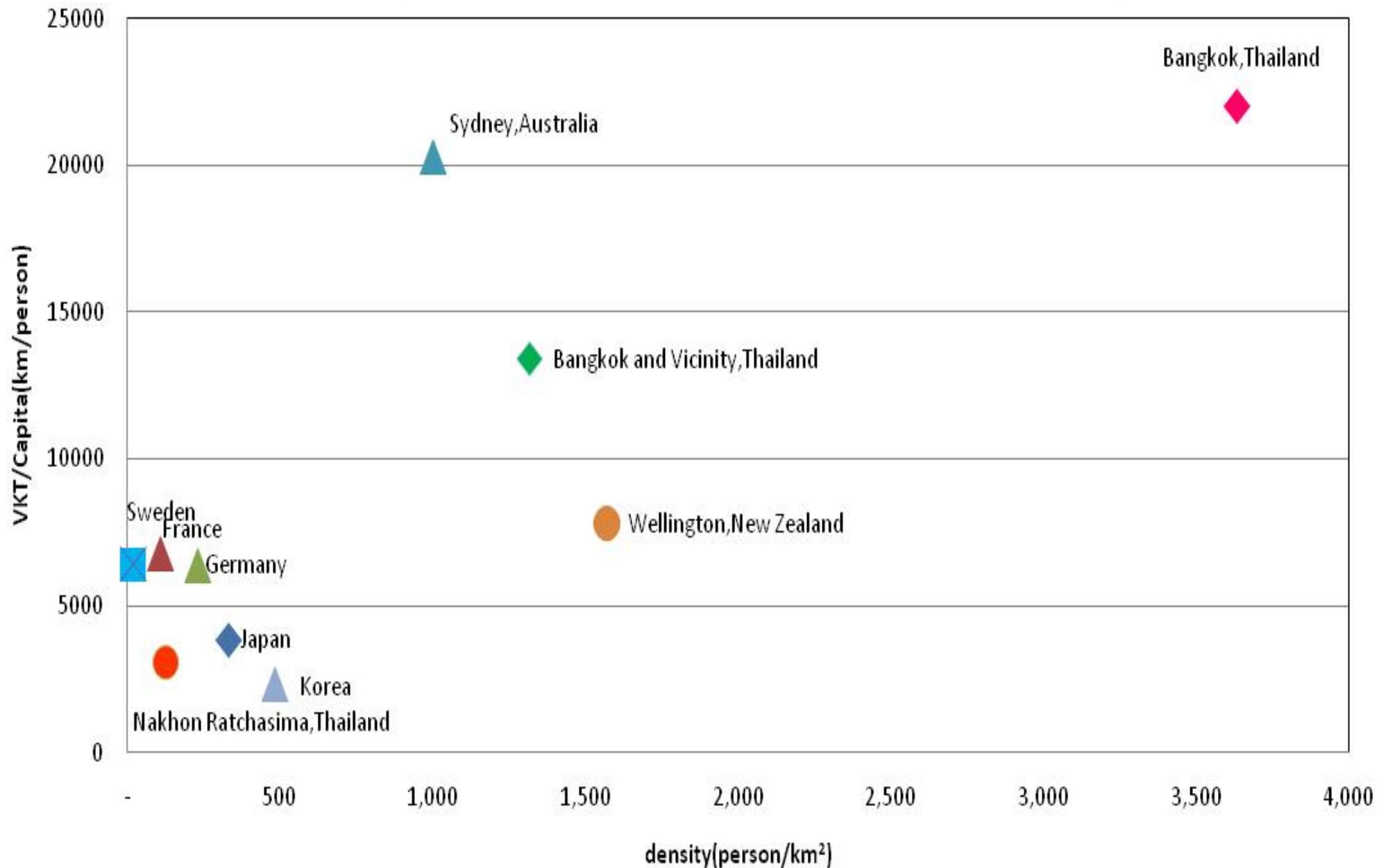
Compare VKT with other cities

Region	VKT per capita (km/person)	density (person/km ²)	GDP (\$)/capita
Japan(1997)	3,811	333	33,577
France(1997)	6,774	107	24,491
Germany(1997)	6,374	230	26,326
Sweden(1997)	6,419	20	28,190
Sydney(2004)	20,300	1,000	19,000
Wellington(2002)	7,800	1,572	6,031
Korea(2002)	2,300	484	11,487
New Mexico(2008)	59,771	56	8,052
Nakhon Ratchasima(2009)	3,092	125	806
Bangkok(2009)	21,988	3,635	5,593

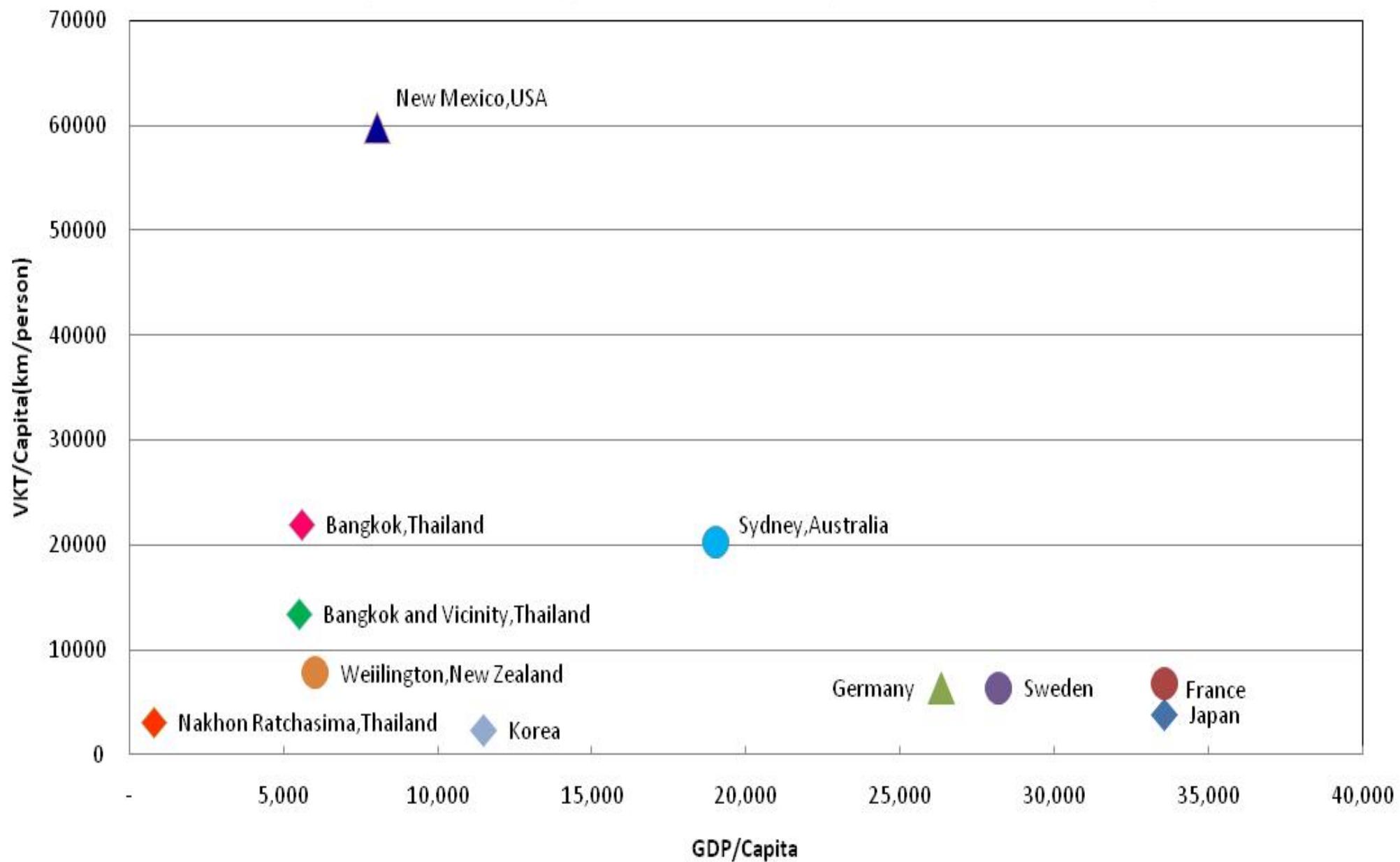
Compare VKT/Capita and Density in other country



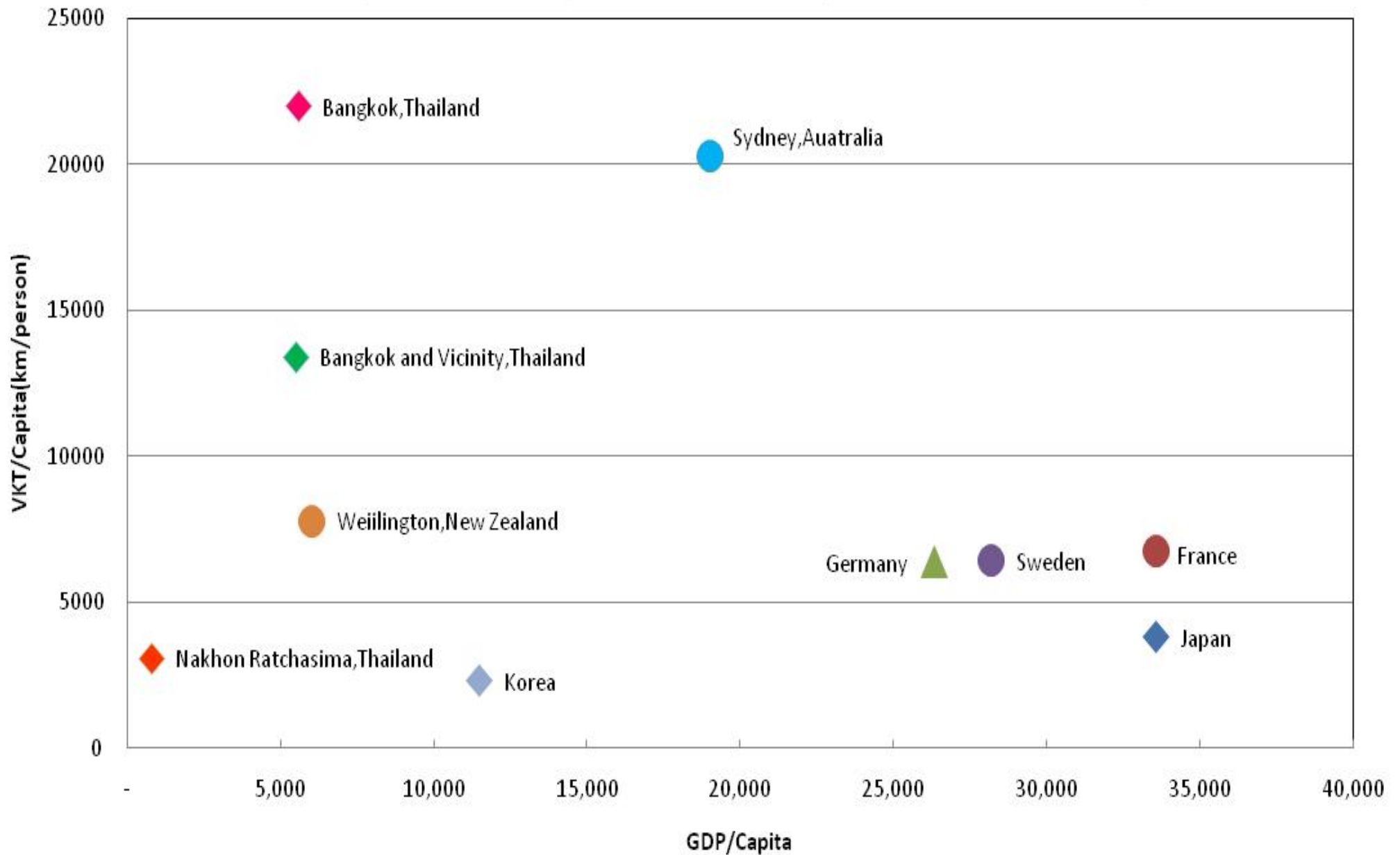
Compare VKT/Capita and Density in other country



Compare VKT/Capita and GDP/Capita in other country



Compare VKT/Capita and GDP/Capita in other country



Research Team



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and Environment**

Jakapong Pongthanaisawan



Thank you
Thank you

