WLTP DHC subgroup	
Date	22 DEC 2009
Title	In-use data collection plan
Author	JAPAN
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1. Introduction

This in-use data collection plan was developed by Japanese experts based on the agreement during DHC meeting.

2. Schedule

After second meeting of DHC, start preparing for testing and expect to complete in-use data collection by the end of Feb.

Table 1 Data collecting schedule

Item	Nov. 09	Dec.09	Jan.10	Feb.10	Mar.10	Apr.10	May.10	Jun.10	Jul.10	Aug.10	Sep.10
1. Review currently available data	→										
2. Test vehicle selection	→	→									
3. Test location/ route selection	→	→									
4. Planning (# of driver, test period, etc.)	→	→									
5. Rental of Vehicle			↔	↔							
6. Data collection			Preparation Calibration	→							
7. Data check & review					→	→	→				
8. Statistical information	→	→	→	→	→						

3. Contents

3.1. Review currently available data

a. JC08 cycle development

1) Research agency : Suuri-Keikaku Corporation

2) Requested by : Ministry of Environment

3) Year : in 2000 and 2001

4) Test vehicle : Total 10 vehicles

Passenger car : 4 vehicles, Light duty commercial vehicle : 6 vehicles,

(see Table2. and Fig1. for more detail)

5) Test condition : In case of LDCVs, the data was collected under three loading conditions (empty/ half load/ full load) . Some data was collected from engine on (i.e. Cold start)
6) Test road : Non-motorway in the two biggest cities (Tokyo metropolitan area, Osaka) and Motorway
7) Total number of data files : 163 files
8) Total driving time : Approx. 300hrs
9) Total driving distance : Approx. 9, 000 km
11) Collected data : Time, Vehicle speed, Engine speed, Coolant temperature and Altitude
10) Sampling frequency : 2 Hz
11) Driver's age/gender : Age: Unknown, Gender: All of them are male.

b. Research for JC08 shift point

1) Research agency : JARI
2) Requested by : JAMA, MLIT
3) Year : in 1999, 2001 and 2003
4) Test vehicle : Total 12 vehicles
Passenger car : 6 vehicles, Light duty commercial vehicle : 6 vehicles
(see Table2. and Fig1. for more detail)
5) Test condition : No load（in 1999: 2 drivers, in 2001 and 2003: 1 driver）for LDCV.
6) Location :
- Tokyo, Osaka, Kyoto, Nagoya, Gifu, Shizuoka, Numazu in 1999
- Metropolitan area（Non-motorway and Motorways）in 2001/2003
7) Total number of data files : 3,800files
8) Total driving time : Approx. 1,400 hours
9) Total driving distance : Approx. 39,000 km
10) Collected data : Time, Vehicle speed, Engine speed and Clutch signal
11) Sampling frequency : 10 Hz

Table 2 Test vehicles

Purpose	Year	Vehicle category	ID	Vehicle name	Fuel type	T/M	Displacement	Riding capacity	Curb mass	GVW	Wn	Max. power	Power to mass ratio
							L	persons	kg	kg	–	kW	kW/t
JC08 Cycle development	2000	PC	1	TOYOTA VITS	Gasoline	AT	1.0	5	860	1135	0.76	51	44.9
	2000	PC	2	MITSUBISHI CHARIOT	Gasoline	AT	2.4	7	1560	1945	0.80	121	62.2
	2000	PC	3	TOYOTA HI-ACE	Diesel	AT	3.0	8	2050	2490	0.82	96	38.6
	2000	PC	4	NISSAN ELGRAND	Diesel	AT	3.0	7	2210	2595	0.85	125	48.2
	2001	LDCV	5	DAIHATSU HIJET	Gasoline	AT	0.70	2	920	1380	0.67	32	23.2
	2001	LDCV	6	NISSAN VANETTE	Gasoline	AT	1.8	3	1310	2225	0.59	66	29.7
	2001	LDCV	7	TOYOTA HI-ACE	Gasoline	AT	2.0	3	1580	2995	0.53	81	27.0
	2001	LDCV	8	NISSAN CARAVAN	Gasoline	5MT	2.0	3	1550	2965	0.52	88	29.7
	2001	LDCV	9	NISSAN VANETTE	Diesel	AT	2.2	3	1380	2295	0.60	58	25.3
	2001	LDCV	10	TOYOTA HI-ACE	Diesel	AT	3.0	3	1650	3065	0.54	67	21.9
JC08 Shift point survey	2003	PC	a	SUZUKI ALTO	Gasoline	5MT	0.66	4	700	920	0.76	40	43.5
	2003	PC	b	TOYOTA VITS	Gasoline	5MT	1.0	5	840	1115	0.75	51	45.7
	2001	PC	c	TOYOTA COROLLA	Gasoline	5MT	1.5	5	1020	1295	0.79	81	62.5
	2003	PC	d	HONDA CR-V	Gasoline	5MT	2.0	5	1440	1715	0.84	116	67.6
	2003	PC	e	HONDA INTEGRA	Gasoline	6MT	2.0	4	1180	1400	0.84	162	115.7
	1999	LDCV	f	SUZUKI EVERY	Gasoline	5MT	0.66	2	800	1260	0.63	31	24.6
	2001	LDCV	g	SUZUKI EVERY	Gasoline	5MT	0.66	2	880	1340	0.66	37	27.6
	2003	LDCV	h	MAZDA BONGO	Gasoline	5MT	1.8	3	1210	2225	0.54	66	29.7
	1999	LDCV	i	MAZDA BONGO	Diesel	5MT	2.2	3	1350	2265	0.60	56	24.7
	2001	LDCV	j	MITSUBISHI LIBERO	Diesel	5MT	2.0	2	1160	1570	0.74	54	34.4
	2003	LDCV	k	MITSUBISHI CANTER	Diesel	5MT	2.8	3	1790	3455	0.52	69	20.0
	1999	PC	l	TOYOTA COROLLA	Gasoline	4AT	1.5	5	1040	1315	0.79	100	76.0

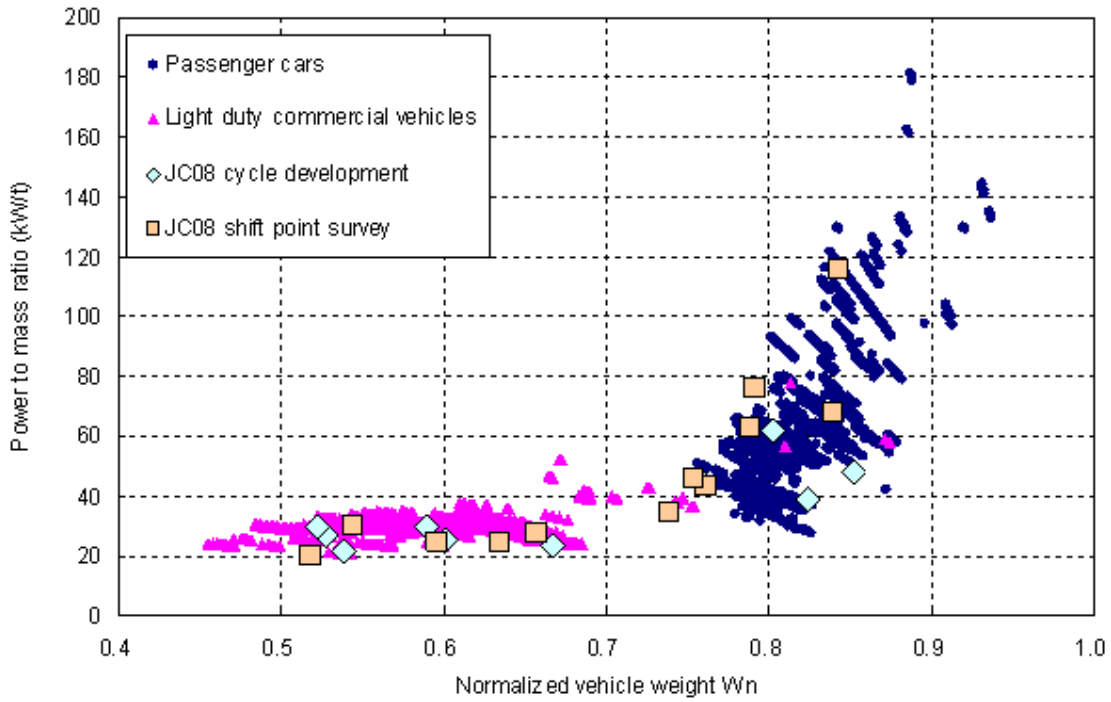

Fig..1 Vehicle specification distribution

Table 3 Detail of currently available data

Vehicle category	Transmission	Vehicle model	Time period	Driver Age	Urban					Rural					Motorway				
					No. of file (#)	Time (hr)	Distance (km)	Time (hr)	Distance (km)	No. of file (#)	Time (hr)	Distance (km)	Time (hr)	Distance (km)	No. of file (#)	Time (hr)	Distance (km)	Time (hr)	Distance (km)
Passenger cars	AT	1999 COROLLA-G 2000 VITS-G 2000 CHARIOT-G 2000 HI-ACE-D 2000 ELGRAND-D	Peak	20's	30	8	130	52	1021	8	4	82	19	369	4	1	37	16	735
				30's, 40's	40	9	139			12	4	96			20	5	269		
				50's, 60's	8	4	68			0	0	0			0	0	0		
				Unknown	15	32	683			5	11	191			8	10	429		
			Off peak	20's	51	12	231	55	1069	27	8	211	27	720	13	6	279	30	1680
				30's, 40's	80	16	304			43	12	347			66	17	973		
				50's, 60's	36	9	173			12	2	74			10	5	274		
				Unknown	9	18	361			2	4	88			1	2	154		
			Weekend	20's	0	0	0	29	606	0	0	0	9	155	0	0	0	13	772
				30's, 40's	0	0	0			0	0	0			0	0	0		
				50's, 60's	0	0	0			0	0	0			0	0	0		
				Unknown	14	29	606			4	9	155			8	13	772		
	5MT	2001 COROLLA-G 2003 ALTO-G 2003 VITS-G 2003 CR-V-G	Peak	20's	16	12	241	60	1037	6	3	60	18	373	2	1	45	15	604
				30's, 40's	129	48	796			29	15	313			28	14	558		
				50's, 60's	0	0	0			0	0	0			0	0	0		
				Unknown	0	0	0			0	0	0			0	0	0		
			Off peak	20's	104	45	888	222	4291	24	12	317	71	1795	50	22	1075	83	4280
				30's, 40's	421	177	3403			100	59	1478			166	60	3206		
				50's, 60's	0	0	0			0	0	0			0	0	0		
				Unknown	0	0	0			0	0	0			0	0	0		
			Weekend	20's	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
				30's, 40's	0	0	0			0	0	0			0	0	0		
				50's, 60's	0	0	0			0	0	0			0	0	0		
				Unknown	0	0	0			0	0	0			0	0	0		
	6MT	2003 INTEGRA-G	Peak	20's	6	3	42	21	381	1	0	10	5	117	0	0	0	6	231
				30's, 40's	46	18	339			12	5	106			11	6	231		
				50's, 60's	0	0	0			0	0	0			0	0	0		
				Unknown	0	0	0			0	0	0			0	0	0		
			Off peak	20's	18	8	133	52	1142	4	2	46	22	566	5	1	78	21	1122
				30's, 40's	119	44	1009			33	20	521			53	20	1044		
				50's, 60's	0	0	0			0	0	0			0	0	0		
				Unknown	0	0	0			0	0	0			0	0	0		
			Weekend	20's	0	0	0	0	3	0	0	0	2	55	0	0	0	2	162
				30's, 40's	2	0	3			6	2	55			8	2	162		
				50's, 60's	0	0	0			0	0	0			0	0	0		
				Unknown	0	0	0			0	0	0			0	0	0		
Light duty commercial vehicles	AT	2001 HIJET-G 2001 VANETTE-G 2001 HI-ACE-G 2001 VANETTE-D 2001 HI-ACE-D	Peak	20's	0	0	0	48	975	0	0	0	11	189	0	0	0	20	833
				30's, 40's	0	0	0			0	0	0			0	0	0		
				50's, 60's	0	0	0			0	0	0			0	0	0		
				Unknown	22	48	975			5	11	189			13	20	833		
			Off peak	20's	0	0	0	28	521	0	0	0	2	35	0	0	0	4	302
				30's, 40's	0	0	0			0	0	0			0	0	0		
				50's, 60's	0	0	0			0	0	0			0	0	0		
				Unknown	13	28	521			1	2	35			2	4	302		
			Weekend	20's	0	0	0	23	554	0	0	0	6	116	0	0	0	29	1615
				30's, 40's	0	0	0			0	0	0			0	0	0		
				50's, 60's	0	0	0			0	0	0			0	0	0		
				Unknown	11	23	554			3	6	116			16	29	1615		
	5MT	1999 EVERY-G 1999 BONGO-D 2001 CARAVAN 2001 EVERY-G 2001 LIBERO-D 2003 BONGO-G 2003 CANTER-D	Peak	20's	41	11	175	85	1438	18	9	187	31	644	19	4	247	23	1258
				30's, 40's	199	59	1033			37	16	335			50	19	984		
				50's, 60's	11	5	81			3	1	36			3	0	27		
				Unknown	4	9	149			2	4	87			0	0	0		
			Off peak	20's	204	75	1374	318	5931	67	25	666	98	2731	114	47	2329	149	7598
				30's, 40's	631	221	4118			183	69	1955			255	93	4793		
				50's, 60's	49	18	365			21	4	110			27	9	476		
				Unknown	2	4	74			0	0	0			0	0	0		
			Weekend	20's	0	0	0	6	150	0	0	0	0	0	0	0	0	6	261
				30's, 40's	0	0	0			0	0	0			0	0	0		
				50's, 60's	0	0	0			0	0	0			0	0	0		
				Unknown	3	6	150			0	0	0			3	6	261		

3.2. Test Vehicle

One (1) passenger car and one (1) light duty commercial vehicle

Since Japan have already collected the in-use driving data on variety of vehicle specifications and most of these data meet the criteria instructed by DHC guideline, the additional data collection will be conducted on average specification vehicle focusing on the driving conditions in where enough data is not available..

3.2.1. Vehicle selection

Plan to procure the test vehicles which possess the average specification.

(normalized vehicle weight and power to mass ratio, taking into account sales volume)

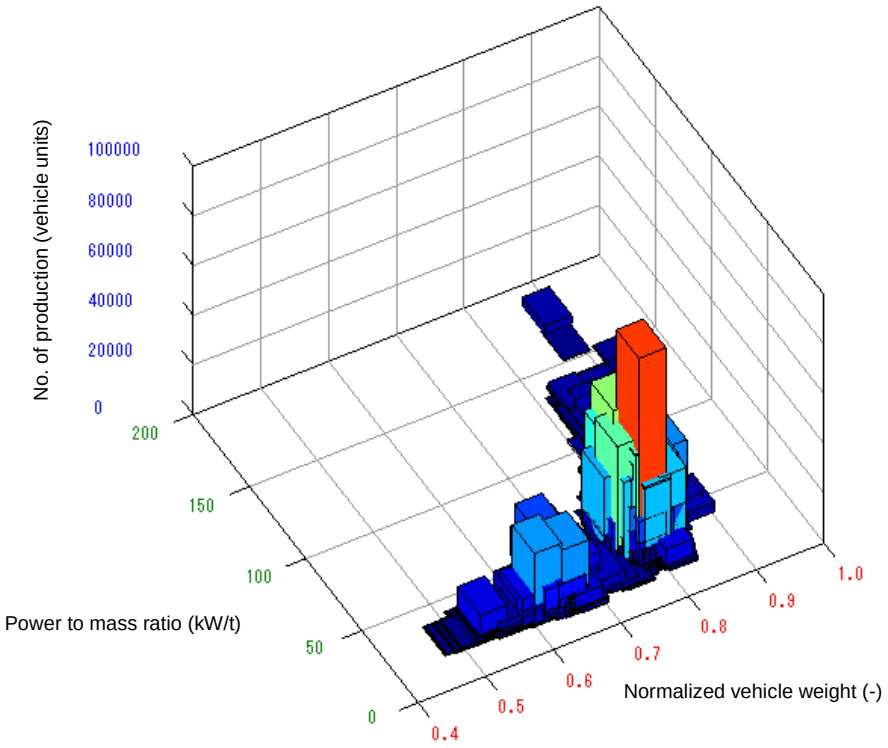

Fig. 2 Normalized vehicle weight, Power to mass ratio and vehicle production

Source : FY2006, FY2008 Vehicle specification (JSAE) and JAMA data

Table 4 Weighted average value of normalized vehicle weight (Wn)
and the weighted average power to mass ratio (PMR) by vehicle type

Type	Wn	PMR
PC	0.80	51.6
LDCV	0.64	31.6

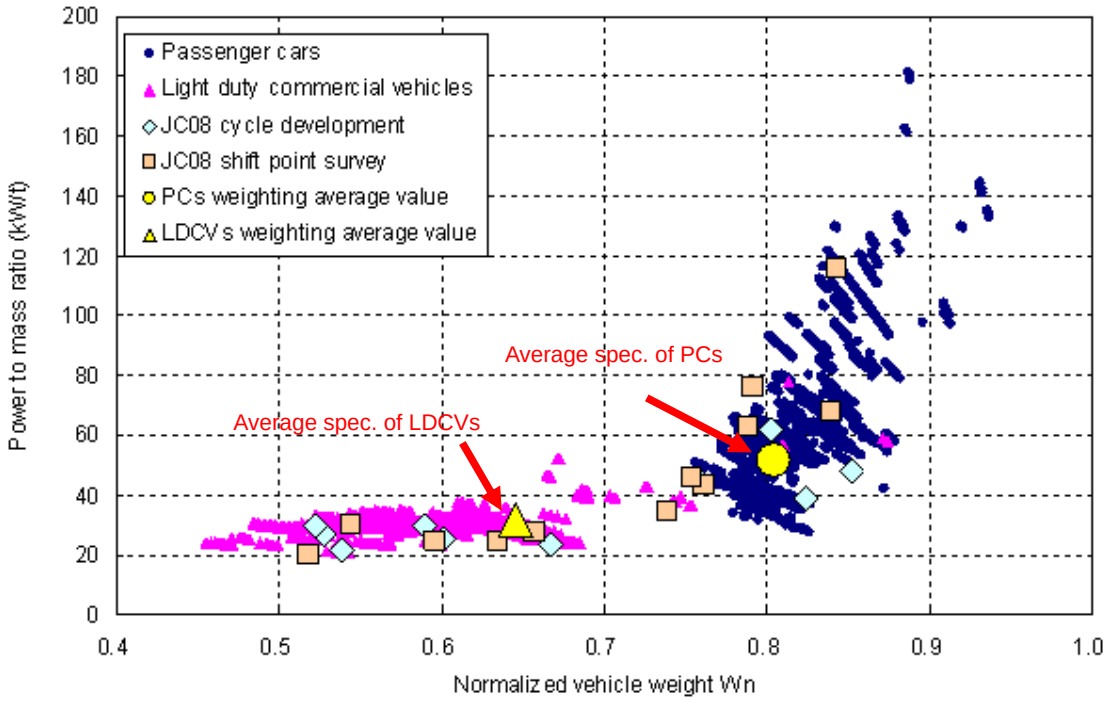

Fig. 3 Vehicle specification distribution

3.2.2. Procurement

Rental car would be better considering road accident insurance and vehicle availability. However, in case of need for ECU information, it would be better to procure a test vehicle with ECU set from auto manufacturers.

3.2.3. Transmission

Sales volume ratio in 2008 : AT(CTV) 97.5％ (passenger car), 67.9％ (light duty commercial vehicle) Therefore, the vehicles with automatic transmission will be first choice.

Table 5 AT sales volume ratio

(Unit: %)

Vehicle category	2006	2007	2008
PCs	96.8	97.2	97.5
LDCVs	59.2	66.8	67.9

3.2.4. Fuel type for LDCV

No big difference is observed between petrol LDCV(1.9million) and diesel LDVC (2.14million). Therefore, test vehicles are selected from rental car based on availability.

3.3. Test location and route selection

3.3.1. Road type definition

Table 6 Definition of road type

	Urban	Rural	Motorway
Suggested WLTP	Paved roads in urban areas with a speed limit ≤50 km/hour (exclude mountain areas)	Paved non-motorways outside and inside urban areas with a speed limit between 50 and 80 km/hour	Paved motorways (multi-lane roads specifically constructed and controlled for fast traffic)
JAPAN	・Densely Inhabited District (DID) ・Speed limit≦60km/h ・exclude mountain areas	・Non-Densely Inhabited District ・Non motorways ・exclude mountain areas	・Motorways（within City and between Cities） ・exclude mountain areas

(*) Photographic/video graphic evidence of roads are also provided.

(*) DID (Densely Inhabited District): neighboring area with population density 4,000/km² or more, and population of 5,000 or more.

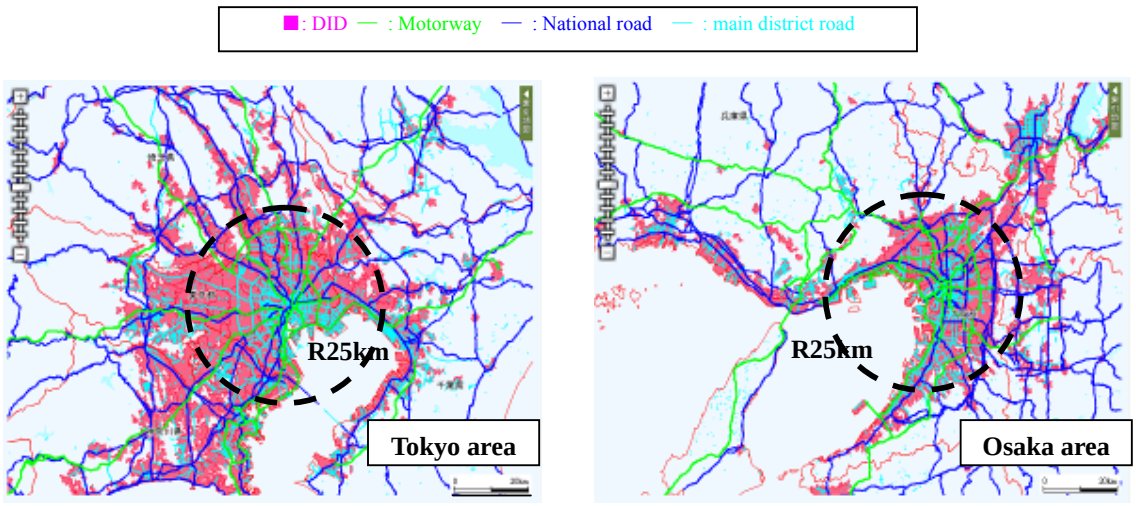

Fig. 4 DID and Main roads in Tokyo and Osaka area

3.3.2. Driving routes and conditions

After re-categorized the current data into new defined road type and time period, the following points for route selection on each road type / time period need to be considered.

1) Urban:

A plenty of data is available. In spite of lack of the weekend data in both vehicle categories compared with “Peak / Off peak” data, the distribution of average speed during weekend is fairly close to off-peak. No plan to collect the additional in-use data.

2) Rural:

Data for LDCV with automatic transmission need to be collected to meet DHC guideline. Mostly the existing data was collected in rural area located close to DID region. New data collection needs to be conducted in more suburban area.

3) Motorway:

A plenty of data is available. However, most of data was collected in metropolitan motorway. The additional data plans to be collected in inter-city motorway.

3.4. Driving condition

3.4.1. Driving behavior

No instruction is made other than to follow overall traffic flow.

3.4.2. Driver selection

Most existing data was collected in 30・40’s and very few in 20’s and 50・60’s.

- Needs consideration when collecting new data
- Driver’s age: 3 generation（20’s, 30 & 40’s and 50 & 60’s）

3.4.3. Season/weather conditions

Data collection will be terminated only when speed limit is intentionally reduced due to weather conditions (snow, heavy rain, etc)

3.4.4. Time of data collection

Data collection will be conducted on each test vehicle during the following period.

Table 7 Data collection plan

Road type	Weekday On-peak	Weekday Off-peak	Weekend
Urban	No	No	No
Rural	Yes	Yes	Yes
Motorway	Yes	Yes	Yes

- On-peak : 7 AM to 9 AM and 5 PM to 7 PM on weekdays

- Off-peak : rest of above hours on weekdays
- Weekend : Weekends (Sat & Sun) and Holidays

3.5. Amount of data to be collect

Table 8 shows the target amount of data to be collected on each test vehicle.

Test vehicles : One Passenger car and One Light duty commercial vehicle

Test period : Approx. 6 days per each vehicle category

Table 8 Detail for additional data collection

Vehicle category	Transmission	Vehicle model	Time period	Amount of currently available data					Additional data collection plan		Total amount of data			
				No. of files	Driving time (hr)	Ave. speed	Driving distance		Driving time (hr)	Driving distance (km)	Driving time (hr)		Driving distance (km)	
Passenger cars	AT	Urban	Peak	93	52	20	1021	2695	No additional data collectionis is planned		52	136	1021	2695
			Off peak	176	55	20	1069				55		1069	
			Weekend	14	29	21	606				29		606	
		Rural	Peak	25	19	19	369	1244	4	140	23	71	509	1904
			Off peak	84	27	27	720		4	160	31		880	
			Weekend	4	9	18	155		8	360	17		515	
		Motorway	Peak	32	16	46	735	3187	8	480	24	91	1215	5587
			Off peak	90	30	56	1680		8	640	38		2320	
			Weekend	8	13	58	772		16	1280	29		2052	
	MT	Urban	Peak	197	80	18	1418	6853	No additional data collectionis is planned		80	354	1418	6853
			Off peak	662	274	20	5432				274		5432	
			Weekend	2	0	15	3				0		3	
		Rural	Peak	48	23	21	489	2906			23	118	489	2906
			Off peak	161	92	26	2361				92		2361	
			Weekend	6	2	28	55				2		55	
		Motorway	Peak	41	21	40	835	6398			21	127	835	6398
			Off peak	274	104	52	5402				104		5402	
			Weekend	8	2	78	162				2		162	
Light duty commercial vehicles	AT	Urban	Peak	22	48	20	975	2050	No additional data collectionis is planned		48	100	975	2050
			Off peak	13	28	19	521				28		521	
			Weekend	11	23	24	554				23		554	
		Rural	Peak	5	11	17	189	340	6	210	17	39	399	1150
			Off peak	1	2	17	35		6	240	8		275	
			Weekend	3	6	19	116		8	360	14		476	
		Motorway	Peak	13	20	41	833	2750	8	480	28	86	1313	5150
			Off peak	2	4	71	302		8	640	12		942	
			Weekend	16	29	55	1615		16	1280	45		2895	
	5MT	Urban	Peak	255	85	17	1438	7519	No additional data collectionis is planned		85	409	1438	7519
			Off peak	886	318	19	5931				318		5931	
			Weekend	3	6	24	150				6		150	
		Rural	Peak	60	31	21	644	3375			31	129	644	3375
			Off peak	271	98	28	2731				98		2731	
			Weekend	0	0	0	0				0		0	
		Motorway	Peak	72	23	54	1258	9118			23	179	1258	9118
			Off peak	396	149	51	7598				149		7598	
			Weekend	3	6	42	261				6		261	

3.6. Measurement item

Table 9 Measurement items

No.	Measurement items	Measurement methods	Notes
1	Vehicle speed	・Drive shaft speed ・ECU ・ABS signal ・GPS	Must
2	Engine speed	・Photoelectric Pick Up ・ECU	MT Must

3	Latitude	・GPS	
4	Longitude	・GPS	
5	Altitude	・GPS ・GPS & Geographic information	
6	Slope	・Calculate from altitude data	
7	Atmospheric pressure	・Pressure sensor	
8	Atmosphere temperature	・Thermo couple	
9	Water temperature	・Thermo couple	
10	Oil temperature	・Thermo couple	
11	Event Maker		
-	Boost / Throttle angle	・Pressure sensor / potential meter	
-	Brake signal	・Contact switch ・ECU （？）	
-	Engine torque	・ECU？（If measureable）	
-	Clutch signal	・ECU ・Contact switch	
-	Gear position	・Position sensor	

4. Statistical information

Japan will generate the weighting factors by using the traffic census data.

The following matrix will be filled out.

Table 10

	Urban			Rural			Motorway		
	Weekday		Week-end	Weekday		Week-end	Weekday		Week-end
	On-peak	Off-peak		On-peak	Off-peak		On-peak	Off-peak	
Passenger Car (PC)									
LD Commercial Vehicle (LDCV)									