(12) **UK Patent Application** (19) **GB** (11) **2 421 830** (13) **A**

(43) Date of A Publication 05.07.2006

(21) Application No: 0428455.0

(22) Date of Filing: 29.12.2004

(71) Applicant(s):
Hon Keung Jonathan Wong
Unit F, 23/F., Block 9, Chi Fu Fa Yuen,
Pokfulam, Hong Kong

(72) Inventor(s):
Hon Keung Jonathan Wong

(74) Agent and/or Address for Service:
Lloyd Wise
Commonwealth House,
1-19 New Oxford Street, LONDON,
WC1A 1LW, United Kingdom

(51) INT CL:
G08G 1/01 (2006.01)

(52) UK CL (Edition X):
G4Q QAH QCD

(56) Documents Cited:
None

(58) Field of Search:
Other: **No search performed: Section 17(5)(b)**

(54) Abstract Title: **A method and apparatus for processing traffic related data**

(57) A method of providing traffic related data comprises the steps of obtaining data for events occurring at a number of locations (P1-P5), processing said data and providing the processed data to at least one end user. The event data may include the time of the event such as the departure or arrival of a vehicle at a specific location. An identity of a vehicle may also be included. The step of obtaining the data may include receiving signals from a vehicle or automatic vehicle locator by a data processing device. The processing device may be a computer which stores the received data. The processing step may include grouping the data according to a time period and the identity of the vehicle. The processing may derive a transit value for vehicles between two points over a predetermined time period. This value may be used to predict future events in the traffic network.
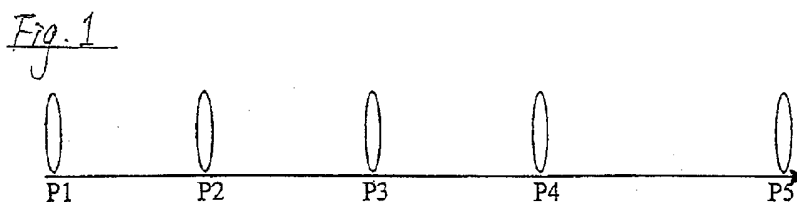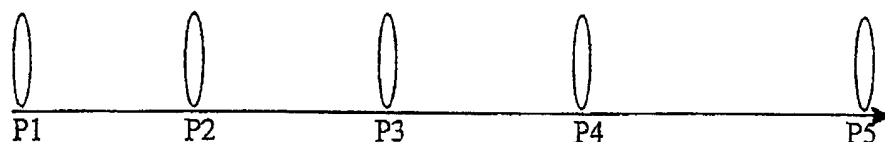
Fig. 1

P1 P2 P3 P4 P5

GB 2 421 830 A

Fig. 1

P1   P2   P3   P4   P5

Table 1

1999 May 03	Point P1 Start HQ	TS-P1-2	Point P2	TS-P2-3	Point P3	TS-P3-4	Point P4	TS-P4-5	Point P5 End HQ	TS-P5-1
Vehicle V1	12:00:35	286	12:05:21	611	12:15:32	181	12:18:33	603	12:28:36	1664
	12:56:20	279	12:06:33	595	12:17:11	266	12:20:25	502	12:29:58	1806
	13:02:55	154	13:07:34	537	13:17:29	298	13:21:55	599	13:30:17	1905
	14:00:23	247	13:10:52	601	13:18:38	298	13:23:21	564	13:31:37	2020
	14:02:10	268	14:04:44	642	14:13:41	278	14:18:39	517	14:28:38	1405
	14:50:45	259	14:05:32	615	14:14:19	316	14:20:59	534	14:29:56	1883
	15:00:15	—	15:04:22		15:14:23		15:19:21		15:28:45	
	16:02:25	154m	15:04:50	537m	15:14:25	—	15:20:12	—	15:29:02	—
	16:03:33	286a	16:08:01	642a	16:18:43	181m	16:23:21	517m	16:31:58	1405m
	16:55:23	263n	16:09:12	606n	16:19:30	316a	16:24:25	603a	16:33:05	2020a
	17:01:01		17:05:20		17:15:35	285n	17:20:51	550n	17:29:45	1815n
	18:01:08		17:06:32		17:15:50		17:22:59		17:30:38	
Vehicle V2	12:15:55	246	12:20:01	654	12:30:55	238	12:34:53	545	12:43:58	1462
	13:08:20	279	12:21:33	575	12:32:11	326	12:35:25	562	12:45:58	1266
	13:15:15	334	13:19:54	657	13:29:29	258	13:34:55	579	13:44:17	1807
	14:05:23	307	13:20:52	781	13:30:48	288	13:35:58	634	13:46:37	1240
	14:15:10	258	14:20:44	532	14:31:41	278	14:35:59	577	14:45:38	1945
	15:15:45	259	14:21:32	675	14:32:19	196	14:37:59	534	14:46:56	1643
	15:16:15	—	15:21:22	—	15:34:23		15:39:11		15:49:45	
	16:10:25	246m	15:22:50	532m	15:35:25	—	15:40:32	—	15:51:02	—
	16:15:33	334a	16:19:51	781a	16:28:43	196m	16:33:21	534m	16:42:58	1240m
	17:15:23	276n	16:21:12	640n	16:29:30	326a	16:34:25	634a	16:43:05	1945a
	17:16:01		17:20:20		17:31:35	266n	17:34:51	566n	17:43:45	1545n
	18:11.08		17:21:32		17:32:50		17:35:59		17:44:38	
Vehicle V3	12:30:35	286	12:35:21	611	12:45:32	301	12:50:33	723	13:02:36	1364
	13:25:20	219	12:36:33	420	12:47:11	381	12:52:25	562	13:03:58	1386
	13:30:55	334	13:34:34	577	13:43:58	378	13:47:55	659	13:57:17	1747
	14:20:23	287	13:35:52	681	13:44:38	258	13:48:21	560	13:58:37	1644
	14:30:10	238	14:35:44	642	14:45:21	338	14:51:39	637	15:02:38	1405
	15:31:45	319	14:36:32	555	14:46:19	256	14:52:59	654	15:04:56	1283
	15:32:15	—	15:37:02		15:48:23		15:52:41		16:02:01	
	16:29:25	219m	15:38:50	420m	15:49:25	—	15:53:52	—	16:03:02	—
	16:31:03	334a	16:35:01	81a	16:45:43	256m	16:51:21	560m	17:01:58	1283m
	17:25:23	283n	16:36:12	596n	16:47:30	381a	16:52:25	723a	17:02:05	1747a
	17:30:01		17:35:20		17:44:35	319n	17:48:51	628n	17:59:45	1450n
	18:21:08		17:36:32		17:45:50		17:49:59		17:30:38	

Table 2

1999 May 04	Point P1 Start HQ	TS-P1-2	Point P2	TS-P2-3	Point P3	TS-P3-4	Point P4	TS-P4-5	Point P5 End HQ	TS-P5-1
Vehicle V1	12:00:00 13 01:20 13:02:55 14:00:23 14:02:10 14:58:45 15:03:15 16:12:25 16:12:33 17:15:23 17:16:01 18:20:08	356 279 274 307 268 259 —— 259m 356a 282n	12:05:56 12:06:33 13:07:34 13:08:52 14:06:44 14:07:32 15:08:22 15:09:50 16:17:01 16:19.12 17:20:20 17:21:32	536 535 717 541 642 615 —— 535m 717a 586n	12:14:52 12:15:11 13:16:29 13:18:38 14:18:41 14:19:19 15:17:23 15:20:25 16:28:43 16:30:30 17:30:35 17:31:50	341 386 358 298 398 316 —— 298m 398a 350n	12:20:33 12:22:25 13:22:55 13:23:21 14:24:39 14:25:59 15:24:21 15:26·12 16:35:21 16:36:25 17:35:51 17:36:59	603 562 659 564 697 594 —— 562m 697a 605n	12:30:36 12:29:58 13:32:17 13:33:37 14:35:38 14:36:56 15:35:45 15:36:02 16:46:58 16.48:05 17:45:45 17:46:38	1844 1686 1387 2020 1527 2063 —— 1387m 2063a 1769n
Vehicle V2	12:15:20 13:18:20 13:19:15 14:15:23 14:18:10 15:15:45 15:17:15 16:15:25 16:16:33 17:14:23 17:16:01 18:15:08	341 279 334 307 257 259 —— 257m 341a 295n	12:21:01 12:21:33 13:23:54 13:24:52 14:23:44 14:20:32 15:22:22 15:22:50 16:20:51 16:21:12 17:20:20 17:21:32	654 335 597 541 473 675 —— 335m 675a 566n	12:31:55 12:32:11 13:29:29 13:30:48 14:33:41 14:30·19 15:31:23 15:32:25 16:28:43 16:29:30 17:31:35 17:32:50	238 386 318 288 278 196 —— 196m 386a 281n	12:35:53 12:35:25 13:35:55 13:37:58 14:38:59 14:39:59 15:36:11 15:37:32 16:33:21 16:34:25 17:34:51 17:35:59	605 442 519 574 577 594 —— 442m 605a 566n	12:45:58 12:46:58 13:43:17 13:45:37 14:47:38 14:48:56 15:45:45 15:46:02 16:42:58 16:43:05 17:44:45 17:45:38	1964 2103 1687 1780 1947 1823 —— 1687m 2103a 1879n
Vehicle V3	12:30:00 13 31:20 13:32:55 14:27:23 14:30:10 15:31:45 15:32:15 16.30:25 16:31:03 17:30:23 17:31:01 18:25:08	286 219 334 287 238 319 —— 219m 334a 283n	12:34:21 12:36:33 13:36:34 13:37:52 14:35:44 14:36:32 15:37:02 15:38:50 16:35:01 16:36·12 17:35:20 17:36:32	611 420 577 681 642 555 —— 420m 681a 596n	12:45:32 12:47:00 13:45:58 13:47.38 14:45:21 14:46:19 15:48:23 15:49:25 16:45:43 16 47:30 17:44:35 17:45:50	301 381 378 258 338 256 —— 256m 381a 319n	12:50:12 12:52:25 13:49:55 13:50:21 14:51:39 14:52:59 15:52:41 15:53:52 16:51:21 16:52:25 17:48:51 17:49:59	723 562 659 560 637 654 —— 560m 723a 628n	13:02:36 13:03:58 13:57:17 13:58:37 15:02:38 15:04:56 16:02:01 16:03:02 17:01:58 17:02:05 17:59:45 18:00:38	1964 1806 1327 2020 1405 1883 —— 1327m 2020a 1765n

Table 3

1999 May 6	Point P1 Start HQ	TS-P1-2	Point P2	TS-P2-3	Point P3	TS-P3-4	Point P4	TS-P4-5	Point 5 End HQ	TS-P5-1
Vehicle V1	12:00:00 13:01:20 13:02:55 14:04:23 14:07:10 15:05:45 15:09:15 16:12:25 16:12:33 17:15:23 17:16:01 18:20:08	296 219 334 307 218 259 —— 218 m 334a 270n	12:04:56 12:05:33 13:06:34 13:07:52 14:12:44 14:13:32 15:14:22 15:15:50 16:16:01 16:19:12 17:20:20 17:21:32	716 595 597 601 702 615 —— 595m 716a 629n	12:16:52 12:17:11 13:16:29 13:17:38 14:22:41 14:23:19 15:24:23 15:25:25 16:27:43 16:28:30 17:30:35 17:31:50	281 446 298 358 338 316 —— 281m 446a 328n	12:21:33 12:22:25 13:23:55 13:24:21 14:27:39 14:28:59 15:30:21 15:31:12 16:33:21 16:34:25 17:35:51 17:36:59	543 502 599 624 697 594 —— 502m 697a 590n	12:30:36 12:31:58 13:32:17 13:33:37 14:36:38 14:37:56 15:40:45 15:41:02 16:44:58 16:45:05 17:45:45 17:46:38	1844 1926 1747 1900 1825 2063 —— 1747m 2063a 1874n
Vehicle V2	12:15:00 13:10:20 13:15:15 14:15:23 14:16:10 15:10:45 15:15:15 16:14:25 16:15:33 17:15:23 17:16:01 18:15.08	301 279 334 307 258 259 —— 258m 334a 287n	12:20:01 12:21:33 13:19:54 13:20:52 14:21:44 14:22:32 15:20:22 15:22:50 16:19:51 16:21:12 17:20:20 17:21:32	654 575 597 661 532 675 —— 532m 675a 622n	12:30:55 12:32:11 13:29:29 13:30:48 14:31:41 14:32:19 15:31:23 15:32:25 16:28:43 16:29:30 17:31:35 17:32:50	238 326 258 288 278 196 —— 196m 326a 266n	12:34:53 12:35:25 13:34:55 13:35:58 14:35:59 14:37:59 15:36·11 15:38:32 16:33:21 16:34:25 17:34:51 17:35:59	545 562 579 574 697 534 —— 534m 697a 565n	12:43:58 12:45:58 13:44:17 13:46.37 14:45:38 14:46:56 15:45:45 15:46:02 16:44:58 16:45:05 17:43:45 17:44:38	1582 1866 1507 1720 1825 1883 —— 1507m 1883a 1748n
Vehicle V3	12:30:35 13:25:20 13:30:55 14.20:23 14:30:10 15:31 45 15:32:15 16:29:25 16:31:03 17:25:23 17:30:01 18:21:08	286 219 334 287 238 319 —— 219m 334a 283n	12:35:21 12:36:33 13:34:34 13:35:52 14:35:44 14:36:32 15:37:02 15:38:50 16:35:01 16:36:12 17:35:20 17:36:32	611 564 577 681 642 555 —— 555m 681a 599n	12:45:32 12:47:11 13:43:58 13:44:38 14:45:21 14:46:19 15:48:23 15:49:25 16:45:43 16:47:30 17:44:35 17:45:50	361 237 318 258 338 256 —— 256m 361a 288n	12:51:33 12:52:25 13:47:55 13:49:21 14:50:39 14:52:59 15:52:41 15:53:52 16:51:21 16:52:25 17:48:51 17:49:59	663 562 719 500 637 654 —— 500m 719a 629n	13:02:36 13:03:58 13:55:17 13:57:37 15:02:38 15:04:56 16:01:01 16:02:02 17:01:58 17:02:05 17:59:45 17:30:38	764 1506 1747 2204 1405 1283 —— 764m 2204a 1485n

Table 4

1999 May 7	Point P1 Start HQ	TS-P1-2	Point P2	TS-P2-3	Point P3	TS-P3-4	Point P4	TS-P4-5	Point 5 End HQ	TS-P5-1
Vehicle V1	12:00:00 13:01:20 13:02:55 14:05:23 14:07:10 15:05.45 15:08:15 16:12:25 16:12:33 17:15:23 17:16:01 18:20:08	356 185 754 307 208 259 185m 754a 283n	12:05:56 12:06:33 13:06:00 13:08·52 14:13:44 14:14:32 15:13:22 15:15:50 16:16:01 16:18:12 17:20:20 17:21:32	596 569 496 659 582 615 496m 659a 591n	12:15:52 12:16:11 13:15:29 13:17:38 14:22:00 14:23:19 15:24:21 15:25:25 16:25:43 16:27:30 17:30:35 17:31:50	.341 472 279 300 278 316 278m 472a 309n	12:21:33 12:22:25 13:23:21 13:24:21 14:26:39 14:28·00 15:29:21 15:31:35 16:30:21 16:31:25 17:35:51 17:36:59	543 476 599 650 637 594 476m 650a 593n	12:30:36 12:31:58 13:31:17 13:33:37 14:36:38 14:37:00 15:40:11 15:41:02 16:40:58 16:41:05 17:45:45 17:46:38	1844 1554 1747 1934 1465 2063 1465m 2063a 1770n
Vehicle V2	12:15:55 13:13:20 13:15:15 14:05:23 14:15:10 15:15:45 15:16:15 16:10:25 16:15:33 17:15:23 17:16:45 18:11:08	300 279 334 307 252 275 252m 334a 290n	12:20:55 12:21:33 13:19:54 13:20:52 14:20:44 14:21:32 15:21:22 15:22:50 16:19:45 16:21:25 17:21:20 17:22:32	600 575 657 781 538 615 538m 781a 612n	12:30:55 12:32:11 13:29:29 13:30:48 14:31:41 14:32:19 15:34:23 15:35:25 16:28:43 16:29:30 17:31:35 17:32:50	238 326 258 288 278 196 196m 326a 266n	12:34:53 12:35:25 13:34:55 13:35:58 14:35:59 14:37:59 15:39:11 15:40:32 16:33:21 16:34:25 17:34:51 17:35:59	545 562 579 634 577 534 534m 634a 566n	12:43:58 12:45:58 13:44:17 13:46:37 14:45:38 14:46:56 15:49:45 15:51:02 16:42:58 16:43:05 17:43:45 17:44:38	1762 1266 1807 1240 1345 1643 1240m 1807a 1504n
Vehicle V3	12:30:35 13:25:20 13:30:55 14:20:23 14:30:10 15:31.45 15:32:15 16:30:25 16:32:03 17:29:23 17:30:01 18:25:08	226 219 334 287 238 344 219m 344a 271n	12:34:21 12:36:33 13:34:34 13:35:52 14:35:44 14:36:32 15:37:02 15:38:50 16:36:01 16:37:12 17:35:45 17:36:32	671 564 577 801 642 470 470m 801a 614n	12:45:32 12:47:11 13:43:58 13:44:38 14:45:21 14:46:19 15:50:23 15:49:25 16:47:43 16:48:30 17:43:35 17:45:50	301 237 378 138 338 316 138m 378a 298n	12:50:33 12:52:25 13:47:55 13:48:21 14:51:39 14:52:59 15:52:41 15:53:52 16:53:21 16:54:25 17:48:51 17:49:59	723 562 659 620 637 654 562m 723a 643n	13:02:36 13:03:58 13:57:17 13:58:37 15:02:38 15:04:56 16:03:01 16:05:02 17:01:58 17:02:05 17:59:45 17:30:38	1364 1386 1747 1644 1645 1523 1364m 1747a 1550n

Table 5

May 10 14:34:23	Point P1 Start HQ	TS-P1-2	Point P2	TS-P2-3	Point P3	TS-P3-4	Point P4	TS-P4-5	Point 5 End HQ	TS-P5-1
Vehicle V1	12:00:35 13:01:20 13:02:55 14:00:23 14:02:10	286 279 154 —— 154m 286a 279n	12:05:21 12:06:33 13:07:34 13:08:52 14:04:44 14:05:32	611 595 537 —— 537m 611a 595n	12:15:32 12:17:11 13:17:29 13:18:38 14:13:41 14:14:19	181 266 298 —— 181m 298a 266n	12:18:33 12:20:25 13:21:55 13:23:21 14:18:39 14:20:59	603 502 599 —— 502m 603a 599n	12:28:36 12:29:58 13:30:17 13:31:37 14:28:38 14:29:56	1964 1806 —— 1806m 1964a
Vehicle V2	12:15:55 13:18:20 13:19:15 14:10:23 14:15:10	266 319 334- —— 266m 334a 319n	12:20:21 12:21:33 13:24:34 13:25:52 14:20:44 14:21:32	611 595 597 —— 595m 611a 597n	12:30:32 12:32:11 13:34:29 13.35:38 14:30:41 14:32:19	181 266 —— 181m 266a	12:33:33 12:32:25 13:38:55 13:40:21	603 502 —— 502m 603a	12:43:36 12:29:58 13:47:17 13:48:37	2084 1386 —— 1386m 2084a
Vehicle V3	12:30:35 13 31:20 13:32:55 14:34:23	286 279 —— 279m 286a	12:35:21 12:36:33 13:37:34 13:38:52	611 595 —— 595m 611a	12:45:32 12:47:11 13:47:29 13:48:38	301 266 —— 266m 301a	12:50:33 12:51:25 13:51:55 13:52:21	723 622 —— 622m 723a	13:02:36 13:03:58 14:02:17 14:04:37	1724 1926 —— 1724m 1926a

Table 6

	Segment P1-2 Norm in Sec.	CI	Segment P2-3 Norm in Sec.	CI	Segment P3-4 Norm in Sec.	CI	Segment P4-5 Norm in Sec.	CI	Segment P5-1 Norm in Sec.	CI	Route P1-5 Norm in Sec.	CI
May 03, 1999	274	0.98	614	1.02	290	1.02	581	0.98	1603	0.98	1759	0.99
May 04, 1999	287	1.02	583	0.97	317	1.11	600	1.01	1804	1.10	1787	1.01
May 06, 1999	280	1.00	617	1.03	294	1.03	595	1.00	1702	1.04	1786	1.01
May 07, 1999	281	1.00	606	1.01	291	1.02	601	1.01	1608	0.98	1821	1.03
May 10, 1999	299	1.07	596	0.99	266	0.93	599	1.02	——	——	1760	0.99
Month of May	281	1.00	600	1.00	285	1.00	594	1.00	1638	1.00	1773 1760	1.00

Table 7

At 14:34:23 Back to 13:34:23	Segment P1	Segment P2	Segment P3	Segment P4	Segment P5
	2	3	4	5	1
Traversing time of Five most recent Events	334sec 154sec 279sec 319sec 279sec	597sec 537sec 595sec 595sec 595sec	298sec 266sec 266sec 266sec 301sec	599sec 622sec 502sec 502sec 723sec	1386sec 1806sec 1926sec 2084sec 1964sec
Occurrence Norm	218.9sec	580.2sec	279.0sec	581.1sec	1738sec
Month Norm	281sec	600sec	285sec	594sec	1638sec
Occurrence CI	0.78	0.97	0.98	0.98	1.06

Table 8

Minutes from 14.34.23	TD-WA at P1		TD-WA at P2		TD-WA at P3		TD-WA at P4		TD-WA at P5	
V1(N-BT at P1): +2.25	+23.22 +82.09	-1.47 +23.22	+29 12 +87.99	+4.73 +29.12	+38.79 +97.66	-3.70 +14.40	+43.44 +102.31	+0.95 +19.05	-5.57 +53.12	-5.57 +10.64
	+140.96	+39.60 +57.70 +82.09	+146.86	+46.26 +63.90 +87.99	+156.53	+38.79 +55.93 +73.57	+161.18	+43.44 +60 58 +78.22	+112.00 +170.87	+28.73 +53.12 +70.26
V2(N-BT at P1): +3.01	+39 60 +99.23	+99.23 +116.87	+46.26 +105.89	+105.89 +123.07	-3.70 +55 93	+97.66 +115.56	+0.95 +60.58	+102.31 +120.21	+10.64 +70 26	+87.90 +112.00
	+158.86	+140 96 +158.86 +176.04	+165.52	+146.86 +165.52	+115.56 +175.19	+132.74 +156.53 +175.19	+120.21	+137.39 +161.18	+129.89	+129.89 +147.07 +170.87
V3(N-BT at P1): +2.55	-1.47 +57.70 +116.87 +176.04		+4.73 +63.90 +123.07		+14.40 +73.57 +132.74		+19.05 +78.22 +137.39		+28.73 +87.90 +147.07	

1

A Method of and an Apparatus for Obtaining, Processing and Providing Traffic-Related Data

This invention relates to a method of and an apparatus for obtaining, processing and providing data relating to traffic on land, in the sea or the air. While such a method and apparatus are most aptly used in relation to transportation on road in the urban area, it is possible to use such a method and apparatus in other situations. While the present invention will hereinbelow be described with reference to transportation on road, such is not intended in any way to limit the application of the method and the apparatus in other traffic situations. In particular, the term "transportation vehicle" used herein is intended to cover all apparatus for locomotion by land, air or water.

The traffic situation on the road at any given moment is affected by a large number of factors, e.g. whether it is a weekday or a holiday, whether it is during rush hours or lunch time, whether it is raining or sunny, and etc. All such factors have a certain bearing on the traffic situation.

It is an object of the present invention to provide a method and an apparatus whereby data indicating the general traffic situation may be obtained, stored, processed, and/or provided to an end user.

It is a further object of the present invention to provide a method and an apparatus whereby a predictive time of occurrence of a future traffic-related event may be provided to an end user.

According to a first aspect of the present invention, there is provided a method of providing traffic-related data including the steps of (a) obtaining data of events occurring at a plurality of locations along at least one traffic route; (b) processing said data; and (c) providing the processed data to at least one end user.

According to a second aspect of the present invention, there is provided an apparatus for providing traffic-related data, including means for obtaining data of events occurring at a plurality of locations along at least one traffic route, means for processing said data, and means for providing the processed data to at least one end user.

An embodiment of the present invention will now be described by way of an example, and

with reference to the accompanying drawings, in which:-

Fig. 1 is a schematic view of a bus route relating to whose situation the method according to the present invention is applied;

Table 1 shows hypothetical raw data relating to the bus route shown in Fig. 1, as captured on 3rd May 1999 and semi-processed information obtained therefrom;

Table 2 shows hypothetical raw data relating to the bus route shown in Fig. 1, as captured on 4th May 1999 and semi-processed information obtained therefrom;

Table 3 shows hypothetical raw data relating to the bus route shown in Fig. 1, as captured on 6th May 1999 and semi-processed information obtained therefrom;

Table 4 shows hypothetical raw data relating to the bus route shown in Fig. 1, as captured on 7th May 1999 and semi-processed information obtained therefrom;

Table 5 shows hypothetical raw data relating to the bus route shown in Fig. 1, as captured on 10th May 1999 up to 14:34:23 and semi-processed information obtained therefrom;

Table 6 shows norm values and coefficient indexes (CI) calculated from the data in Tables 1 to 5;

Table 7 shows hypothetical data for a first application of the method according to the present invention as applied to the bus route represented in Fig. 1; and

Table 8 shows hypothetical data for a second application of the method according to the present invention as applied to the bus route represented in Fig. 1.

The present invention may be implemented by information technology devices, such as various electronic devices, optical devices or applicable sensors, computer hardware, computer software packages, e.g. a relational database management system (RDBMS) traded by Oracle Corporation under the name "Oracle 8™ Object-Relational Data Server", Data Warehouse and Data Mart (see e.g. "DKMS Briefs" by Joseph M. Firestone in http://www.dkms.com/DWDMED.html), networking products, communications systems (wired or wireless) and various kinds of switching systems. From the operational and functional aspects, a system for implementing a method according to the present invention includes:-

a. data acquisition mechanisms, which make use of various kinds of channels and methods.

In particular, such channels and methods include the use of automatic vehicle locator (AVL) technologies, e.g. Global Positioning System (GPS), manual input processes, e.g.

manual input *via* keyboard, and importation of information or data from other database(s);

b.   data repository for storing data and/or information obtained after the data are processed; and

c.   data provision mechanisms for export of data to other database(s), and knowledge transfer to requestor(s) *via* various kinds of display device or broadcasting technology, e.g. by radio frequency broadcasting or *via* a mobile phone system.

A basic characteristic of this invention is the construction of route skeletons/route data structure in the cyberspace/repository, and the mapping of these to traffic routes on the streets, roads, water ways, air ways, arterial or trunk road in the physical traffic infrastructure. For implementing this invention, the following equipment and computer software packages may be used:-

i.   equipment installed along specific locations along the traffic route as data and/or image capturing devices. Such include devices using digital enhanced communication telephone (DECT) technology, PHS technology, Bluetooth, CCTV camera, camera with MPEG-4 capability, or radar receiver. In less densely populated areas, global positioning system (GPS) or defence global positioning system (DGPS), or Location-Capable mobile phone may be considered for avoiding some of the financial and/or technological weaknesses or disadvantages which may arise from the use of roadside short range transceivers;

ii. networking services provided by information technology (IT) infrastructure providers, such as public switching telephone networking (PSTN) providers, Internet service providers, or Internet2 service providers; and

iii. relational database management system (RDBMS) packages, data warehouse packages, data mining packages and data mart packages as computer software tools.

By using the above equipment and etc., raw data relating to traffic conditions or mobile objects, e.g. transportation vehicles, may be captured, transmitted, recorded, analyzed, processed, extracted and transformed to become cyber route skeleton data structure attached or linked to relevant data, information, index figures or knowledge relating to traffic status, e.g. in a city.

The cyber route skeleton is built up by applying a normalization process on raw datum

packets selected of a same category according to pre-defined criteria. Relative coefficient indices or figures are then obtained on the basis of such results of normalization for reflecting the general traffic condition of the physical traffic route(s) or segment(s) within a specific traffic route.

By using the route side/roadside data capturing equipment as stationary base station with known location identification, discrete data or image of nearby mobile objects, e.g. transportation vehicles, may be captured and stored in a computer server repository *via* network service provided by PSTN providers, Sonet/SDH or Internet/Internet2 networking within the city information technology infrastructure. The datum packet is in the following format:-

$$(\text{T-Log}, \text{L-ID-BS}, \text{D-MT}_1, \text{D-MT}_2, ...\text{D-MT}_n)$$

in which:-

- T-Log is the time of logging and storing of the datum packet, and represents the time of occurrence of a traffic-related event. This may be the system time on the server side in a networking service with Quality of Service (QoS) or the system time on the base station of route side in a networking service without QoS.

- L-ID-BS is the location identification of the base station on route side

- D-MT_1 to D-MT_n are data items relating to the mobile object (e.g. transportation vehicle) which occasions the data capturing. Such data items may consist of two categories:-

    a.   discrete data mode with active capturing method – the data items are in the form of digital format originating from the mobile object, and may include:-

        i.   mobile object identification;

        ii.   mobile object driver identification;

        iii. number of passengers on the mobile object;

        iv. occupancy rate of the mobile object.

    b.   image mode with passive capturing method – discrete data may be extracted by pattern recognition technique from image captured with cameras or sensors in different spectrum. While the conversion of analogue signals to digital signals in compressed digital form is best carried out by the route side equipment, the

recognition process is best carried out at sever platform. The quality and quantity of data extracted from frames of image depend on the sophistication and capability of the pattern recognition technique employed and the sensitivity or resolution of the cameras or sensors. Such data may consist of:-

i.   mobile object count per frame;

ii. mobile object count per line of lane;

iii. mobile object type or category (e.g. buses, private cars, taxis, motorcycles, lorries etc.);

iv. relative distance between mobile objects in the same line of lane;

v.   mobile object identification.

The raw datum packets are grouped in the order of Date/Time/Base-Station and stored in the cyberspace with RDBMS package in the system server platform.

Seven route types are identified according to their different characteristics:-

a.   PB-TS Route Type

b.   FB-DS Route Type

c.   TR-TS Route Type

d.   WR-TS Route Type

e.   AC-DS Route Type

f.   IMS Route Type

g.   LG Route Type

PB-TS Route Type

A route of the PB-TS Route Type is built from data derived from public busing and routing in a pre-defined pickup and/or delivery points (P-PD) reserved for bus vehicles in a sequence of which buses traverse in order, starting and ending at a depot. The datum packets naturally form a time component with T-Log as the key. The basic format of raw datum packet is:-

(T-Log, L-ID-BS, D-MT)

where   T-Log is the Arrival Time (T-Arr) or Departure Time (T-Dep) (as the case may be) of a vehicle;

L-ID-BS is the location indication information of the base station;

D-MT is the targeted mobile data which, in this case, is the Vehicle Identification (ID-V).

The Point of Pickup and/or Delivery (P-PD) may be arranged so as to be close to or to coincide with the location of the route side base station. The Vehicle Identification is the D-MT mobile targeted data. In other words, the nearby mobile object data can be organized in the datum packet with L-ID-BS Identification and Vehicle Identification as keys. The traversing time of vehicles in the pre-configured routes may then be used for constructing a cyber route skeleton.

In this connection, a number of abbreviations and their definition are provided as follows:-

T-Arr: "Time of Arrival" for a transportation vehicle relative to a P-PD is the same as the Time of Logging in the datum packet under consideration

T-Dep: "Time of Departure" for a transportation vehicle relative to a P-PD is the same as the Time of Logging in the datum packet under consideration

TD-TT: This is the length of time during which a transportation vehicle stays at a P-PD, and equals to:-

$$T\text{-}Dept - T\text{-}Arr$$

of the same P-PD

TD-TS: This is the time duration for a transportation vehicle to traverse from a P-PD (P-PD$_n$) to a next succeeding P-PD (P-PD$_{n+1}$) along the same route, and equals to:-

$$T\text{-}Arr\ (of\ P\text{-}P\ D_{n+1}) - T\text{-}Arr\ (of\ P\text{-}PD_n)$$

TD-TL: This is the time duration for a transportation vehicle to travel from a P-PD (P-PD$_n$) to a next succeeding P-PD (P-PD$_{n+1}$), and equals to:-

$$TD\text{-}TS - TD\text{-}TT$$

ON-TS: Occurrence Norm of Traversing Time is a norm value calculated with TD-TS of the relevant events occurring in the relevant route or segment of the route, and in a dimension between the point of occurrence and historical point and/or recent

samples selected with specific criteria.

HN-TS: Historical Norm of Traversing Time is a norm value calculated with TD-TS of the relevant route or segment of route in a time domain of historical points of time and/or datum packets selected with specific criteria.

CI-TS: Coefficient Index of Traffic Status is an index reflecting the traffic status of a route or a segment of a route. If such relates to a point of occurrence, it is called "Occurrence CI-TS". Otherwise, it is called "Historical CI-TS" or simply "CI-TS". Different criteria for selecting the datum samples, different methods of normalization and different raw data selected will bring about different CI-TS.

We should also take note of the following concepts:-

- Normalization – such is defined as the process of calculating or defining the norm value of samples among members of a domain

- Coefficient Index – such is defined as the ratio between the norm of a domain over the norm of its super domain. Such are used for reflecting the general traffic condition

- Time Dimension: Data items or events are viewed or arranged in time sequence

- Time Domain: Domain of events arranged in dimension

As an example, Fig. 1 is a schematic view of a bus route with P1 as the starting point, P5 as the end point, and P2 to P4 as intermediate Points of Pickup and/or Delivery (P-PDs). This route thus consists of four segments, namely P1-2, P2-3, P3-4 and P4-5. Assuming that three buses (V1, V2 and V3) provide bus service along this route. Their hypothetic Logging Time in hh:mm:ss format (hour 00-23: minute 00-59: second 00-59) for the days 3 May 1999, 4 May 1999, 6 May 1999, 7 May 1999 and 10 May 1999 are shown in Tables 1 to 5 respectively.

For the purpose of reducing complexity, only the above five days are selected for building the cyber route with the criteria as the traffic condition between 12:00 noon to around 18:00:00 with non-holiday and regular weather condition. The last day, i.e. 10 May 1999, is the day of occurrence and the current time is assumed to be 14:34:23. It should be noted that as P1 is the starting point of the route where bus drivers have their break, the time of departure and arrival for each bus is handled differently from other P-PDs in respect of traversing calculation.

Take Table 1 as an example, on 3 May 1999, bus V1 departed from P1 at 12:00:35 and traversed for 286 seconds (i.e. 4 minutes 46 seconds) to arrive at P2 at 12:05:21, traversed for 611 seconds (i.e. 10 minutes 11 seconds) to arrive at P3 at 12:15:32, traversed for 181 seconds (i.e. 3 minutes 1 second) to arrive at P4 at 12:18:33, traversed for 603 seconds (i.e. 10 minutes 3 seconds) to arrive at P5 at 12:28:36. The time 12:06:33, 12:17:11, and 12:20:25 denote the actual time at which V1 departed from P2, P3, and P4 respectively. Upon arrival of P5, V1 traversed for 1664 seconds (i.e. 27 minutes 44 seconds) to arrive at P1 at 12:56:20. As to the route P5-1, such may or may not pass through P2, P3 and/or P4.

For the same V1, it departed from P1 again at 13:02:55, traversed for 279 seconds to arrive at P2 at 13:07:34, traversed for 595 seconds to arrive at P3 at 13:17:29, traversed for 266 seconds to arrive at P4 at 13:21:55, traversed for 502 seconds to arrive at P5 at 13:30:17, and traversed for 1806 seconds to arrive at P1 at 14:00:23. The time 13:10:52, 13:18:38, 13:23:21 and 13:31:37 denote the actual time at which V1 departed from P2, P3, P4 and P5 respectively.

For V1, the maximum TS value for the route segment P1-2 (TS-P1-2) on 3 May 1999 is 286 seconds (denoted by a subscript a), and the minimum TS value for the route segment P1-2 on 3 May 1999 is 154 seconds (denoted by a subscript m). The norm value (denoted by a subscript n) is calculated by first removing the maximum TS value and the minimum TS value. An arithmetic mean is then taken of the remaining four TS-P1-2 values, i.e.

$$(279+247+268+259)/4 = 263$$

For the Occurrence Norm in this example, such is defined as in the following Formula 1:-

$$\text{Norm of Occurrence} = \Sigma_{n=1,j} (TS_n \times n)/\Sigma_{n=1,j} n$$

where TS_n is the Traversing Time of Logging Events of all relevant vehicles within the timeframe window from point of occurrence and backward to historical point of time per relevant segment or route. The Logging Event, indexed as 1, is the oldest and Event j is the most recent one.

In general, sample selection criteria and norm calculation definition are subject to

specification or requirements from system designer(s) and/or end user(s). For instance, the selection criteria, instead of referencing to timeframe window, can use number count of historical Logging Events from Point of Occurrence. In addition, n^2, instead of n, may be used in the formula for emphasizing the recent Occurrence.

Due to limited number of buses and days involved, and the absence of any substantial accidental events, the daily segment norm of traversing time among all vehicles in May 1999 are arrived at by using an average method without further filtering. Since the month of May 1999 is the largest domain in this example, the norm of the segment in the month of May 1999 is calculated with average method after dropping the maximum value, and will be used as a base factor for calculating the Coefficient Index of Traversing Time. The calculation results are shown in Table 6.

Taking Segment P1-2 as an example, the maximum value "299" is dropped, and the arithmetic mean is taken of the remaining values as follows:-

$$(274+287+280+281)/4 = 281$$

Since the Coefficient Index in this case is built from the traversing time (TS), its value will reflect the general status of the traffic condition. While a high CI value represents serious traffic congestion, the best traffic flow or condition is a CI value approaching zero.

With the completion of the building of this traffic route P1-5, two simple applications are possible. Let the Point of Occurrence be 14:23:23 of 10 May 1999 and its historical point of backward window extends to 13:23:23 of 10 May 1999 with Event count of less than 5. Its Norm of Occurrence (as defined in Formula 1 above), and its Coefficient Index of Occurrence Norm with respect to the month of May 1999 as normalization factor, are shown in Fig. 7.

Let us define the Occurrence CI of the Route P1-5-1 as the arithmetic mean of Occurrence CI of P5-1, and mixed Occurrence CIs of Route P1-5.

Norm of Break Time (N-BT) at P1 per vehicle is defined as the product of the Occurrence

Norm of Route P1-5-1 and the Average Break Time per vehicle over the month of May 1999.

A first application of such a method involves Bus Arrival Schedule Reporting. At 14:34:23 of 10 May 1999, the information as shown in Table 8 can be shown or disseminated. The Waiting Time for Arrival (TD-WA) in terms of minutes at P-PD points will be updated during the Event of Occurrence for every bus which arrives at any of the P-PD points, which activates the Events logged and stored into the system. Note that the negative values of TD-WA means that the Event drifts into past as time goes on.

A second application involves the prediction of a future time for the arrival of a bus. In this example, we are trying to give a prediction of the time of travel of a private car from P2 to P4 with a starting time of 14:34:23. Assuming that there is no material difference between a private car and a bus, except that a private car does not have any transition time for traversing a P-PD point. The traversing time is thus increased by a factor of FT-SC as defined in the following formulae:-

Formula 2

$$FT\text{-}SC = (1 - \Sigma_{p=2,5} (T\text{-}Arr - T\text{-}Dep))/\Sigma_{n=all} TS$$

Where FT-SC stands for "Traversing Factor of Standard Automobile", and all transition events at all points except the starting point P1.

As for TD-TS (Traversing Time of Standard Car),

Formula 3

$$TD\text{-}TS = FT\text{-}SC \times \Sigma TS \text{ of Occurrence}$$

Where TS is Occurrence Norm of Traversing of segments concerned, or P2-3 and P3-4 in this example.

For carrying out this invention, it is possible to arrange for a central processing unit, e.g. a main frame computer installed with appropriate application software, e.g. one traded under the name "Sybase Adaptive Server IQ^{12}" by Sybase, Inc.. The computer is also connected with a number of signal receivers and signal transmitters. Signals relating to the various data

mentioned above may be transmitted to and be received by the signal receivers connected to the central processing unit. The central processing unit will then group and process the data, and store them for possible use.

Certain end users, e.g. bus companies, government departments (e.g. Transport Department), may require such data for statistical, analytical, and/or planning purposes. It is also possible for certain end users, e.g. a passenger on a bus, or an individual waiting for a bus at a bus stop, to make inquiries with the system, e.g. *via* his/her mobile phones. Such inquiries may include the estimated additional time for the bus he/she is travelling on to arrive at the next stop, or the estimated additional time for a bus of a certain route to arrive at a certain bus stop. Requests for such information are received by the signal receivers connected to the central processing unit/computer of the system. The computer will then process the data according to the predefined formulae, and the parameters inputted by the requesting end user(s). The results are then sent to the requesting end user(s) *via* the signal transmitters of the system, e.g. *via* a mobile phone system.

FB-DS Route Type

The main characteristics of a route of the FB-DS Route Type are the same as one of the PB-TS Route Type, except that for a route of the FB-DS Route Type, there is no fixed point of pickup and delivery, although the actual route is pre-defined, same as a route of the PB-TS Route Type. A pre-defined route run by mini-buses may fall within this route type. The basic format of raw datum packet is as follows:-

$$(\text{T-Log, L-ID-BS, D-MT}_1, \text{D-MT}_2)$$

where   T-Log: Arrival Time or Departure Time (as the case may be);

L-ID-BS: Location of Base Stations set up along the road side of the route;

D-MT$_1$:   Vehicle Identification

D-MT$_2$:   Vehicle Location Information (which is called "L-DS" after pre-processing)

In this route type, as different from the case of PB-TS Route Type, the vehicle P-PD points

may not coincide with or be near to the base stations. An extra raw data item, i.e. D-MT$_2$, is thus required. The original form of this data item after capturing may be expressed in terms of longitude/latitude, or in terms of angle or degree format. However, after certain pre-processing work has been carried out, only a positive or negative value (called L-DS) is stored in the system. In this connection, L-DS represents the distance between the transportation vehicle in question and the base station, in which a positive value means that the vehicle has passed a certain base station, while a negative value means that the vehicle is still upstream of a certain base station and has yet to arrive.

The basic method and procedure to construct a cyber route of the FB-DS Route Type are essentially the same as that for constructing one for the PB-TS Route Type, although extra effort and overhead are required to handle the extra piece of raw data item, namely L-DS. In particular, in a route of the PB-TS Route Type, the Logging Datum Packet includes T-Arr and/or T-Dep. However, in the FB-DS Route Type, it is necessary to handle (T-Arr, L-DS) and/or (T-Dep, L-DS). When it comes to the handling of the traversing time (TD-TS), an effective traversing time (TD-TS-EFF) is defined as:-

$$TD\text{-}TS\text{-}EFF = TD\text{-}TS \times (1 + L\text{-}DD/L\text{-}BS)$$

where   TD-TS-EFF is the effective traversing time;

        L-BS is the known segment length between two Base Stations;

        L-DD is the distance between two L-DS of two consecutive logging events; and

        TD-TS is the traversing time.

Of course, with the availability of more data as stored, more features or applications can be provided by a system with a FB-DS Route Type feature.

TR-TS Route Type

This Route Type is a mixture of PB-TS Route Type and FB-DS Route Type, with the following important features:-

- exclusive usage of dedicated road or rail track
- no transition event between base stations

- requirement on tracking and reporting the vehicle status in details between base stations. A train route is an example of such a Route Type. The datum packet format is as follows:-

$$(T\text{-}Log, L\text{-}ID\text{-}BS, D\text{-}MT_1, D\text{-}MT_2, D\text{-}MT_3, ... D\text{-}MT_i)$$

where   T-Log: Arrival Time or Departure Time (as the case may be)

         L-ID-BS: Location of Base Station

         $D\text{-}MT_1$:   Vehicle Identification

         $D\text{-}MT_2$:   Vehicle Location Information (which is called "L-DS" after pre-processing)

         $D\text{-}MT_3$:   Vehicle speed (if changed during travelling)

         $D\text{-}MT_4$:   Passenger count on the vehicle (called "N-PA")

         $D\text{-}MT_i$:   goods information, etc.

The method or procedure of handling this Route Type are basically the same as in the case of FB-DS Route Type, with the following exceptions:-

- the speed information allows cross checking of the validity of the information relating to the location of the vehicle, and reporting with a high degree of accuracy the location of the vehicle, at any point of time. Using the following formula:

Formula 4

$$distance = traversing\ time \times speed$$

to arrive at the distance, the result can be compared to location result obtained from the next logging datum packet. Unless the loading of passengers and goods carries tremendous weight and consumable factors, passenger count ($D\text{-}MT_4$, or called "N-PA") and goods information ($D\text{-}MT_i$) are mainly for reporting purposes, and should not affect the traffic status. The absence of any transition between base stations will simplify the handling process, as compared with PB-TS Route Type and FB-DS Route Type.

- in this type of dedicated vehicle and track situation, some of the information/data may be exchanged with other database(s) *via* information networking in pre-defined protocol or pre-agreed format. Most of the conceptual technique used in the case of PB-TS Route Type and FB-DS Route Type can be applied for building a cyber route of TR-TS Route

Type.

- as for the interpretation of the coefficient index, it should mean differently from the other Route Types, in particular since the rail track or road is dedicated for the use by relatively small number of vehicles or train on a single track.

WR-DS Route Type

The characteristics of a route of this Route Type are the combination of PB-TS Route Type, FB-DS Route Type and TR-TS Route Type. Its unique feature is that the vertical displacement distance from, say, the central line of the traffic route, is concerned. This kind of route includes highways with lines, wider rivers for traversing, and narrow harbours functioning as waterway. The transportation vehicle may be cars, ships, boats, etc. The datum format is as follows:-

$$(\text{T-Log, L-ID-BS, D-MT}_1, \text{D-MT}_2, \text{D-MT}_3, \dots \text{D-MT}_i)$$

where   T-Log: Arrival Time or Departure Time (as the case may be)

L-ID-BS: Location of Base Station

D-MT_1:   Vehicle Identification

D-MT_2:   Vehicle Location Information (which is called "L-DS" after pre-processing)

D-MT_3:   Vehicle speed (if changed during travelling)

D-MT_4:   Passenger count on the vehicle (called "N-PA")

D-MT_5:   Vertical distance in question (also called as "L-FC" (Length from Centre of Route), or "N-CH" (Channel Number with the Route))

D-MT_i: goods information, etc.

If the driver of the vehicle is just using the L-FC/N-CH information for reference purposes, and he/she has other means to avoid collision, such data item is attached to the Logging Datum Packet as a reference for the traffic status impact. Alternatively, a group of Routes may be created with N-CH or L-FC in discrete and incremental manner as part of Route Identification key.

Most of the technique as used in the case of PB-TS Route Type and FB-DS Route Type can be applied to build up a cyber route of the WR-TS Route Type. In addition, most of the technique used in the case of PB-TS Route Type and FB-DS Route Type can also be applied to build up a cyber route of the TR-TS Route Type.

AC-DS Route Type

The main characteristics of this type of route are essentially the same as those of the FB-TS Route Type, except that the AC-DS Route Type is for a traffic route for an aircraft which is circulating in the air before landing onto an airport, or has just taken off from an airport. GPS or DGPS technology is ideal for tracking the position of the aircraft. Information (in the form of radio signals) relating to the location of the aircraft is transmitted and/or relayed to the airport control. In this case, there are only virtual base stations, instead of physical road side devices which are defined and positioned at certain points of the air traffic route. The basic format of raw datum packet is in the following form:

$$(T\text{-}Log, L\text{-}ID\text{-}BS, D\text{-}MT_1, D\text{-}MT_2)$$

where T-Log: Arrival Time or Departure Time (as the case may be);

L-ID-BS: Location of virtue Base Stations;

$D\text{-}MT_1$:   Aircraft Identification

$D\text{-}MT_2$:   Aircraft Location Information (which is called "L-DS" after pre-processing)

As compared to the FB-DS Route Type, it should be understood that an aircraft does not have any points of pickup and/or delivery (P-PD) along its route, except the starting point and the end point. However, all original location inputs are in terms of longitude/latitude, or in angle or degree format. After pre-processing, a positive or negative number (called "L-DS") will be arrived at and stored in the data repository. A positive L-DS value indicates that the aircraft has passed the base station in question, while a negative L-DS value means that the aircraft is still upstream of, and thus has yet to reach the base station in question. The method or procedure for building up the cyber route of the AC-DS Route Type is the same as those in the case of the FB-DS Route Type.

IM-CT Route Type

The main characteristic of this Route Type is its way of capturing traffic-related information into the system. The original raw data are in the form of video image or acoustic wave, which is non-discrete. Such data were scanned and captured by route side CCTV, cameras or other kinds of image/sound sensing devices. The datum packet format is as follows:-

$$(T\text{-}Log, L\text{-}ID\text{-}BS, D\text{-}MT_1, D\text{-}MT_2, D\text{-}MT_3 \dots D\text{-}MT_i)$$

where   T-Log: Frame Identification (also called "FI-TL)

L-ID-BS: Location of the Base Station in question

$D\text{-}MT_1$: Number of Mobile Objects per Frame ("N-MPM")

$D\text{-}MT_2$: Number of Mobile Objects per line or lane per Frame

$D\text{-}MT_3$: Relative Distance between Mobile Objects per line or lane

$D\text{-}MT_i$: Any other kind of information about Mobile Objects.

The mobile object identification is not adopted as a mandatory component of the datum packet. On the other hand, Frame Identification (FI-TL) with reference to incremental T-Log is used as key. Analog-to-digital conversion and pattern recognition techniques are applied on the images and/or sound captured.

The kind of D-MT depends on the quality of the image or sound wave form and the capability of the pattern recognition equipment and technology. Some of these may be extracted, defined and shown as mobile targeted data in the above datum packet. Most of the conceptual technique as used in the case of the PB-TS Route Type and FB-DS Route Type can be used for building a IM-CT Route Type. Such a Route Type reflects the dynamic traffic status or flow on a macro level by counting mobile objects and/or keeping track of their relative variation.

LG Route Type

The characteristic of this Route Type is that there is no corresponding physical route. This

type of route is created by joining consecutive or adjacent segments of Routes which belong to the same Route Type and same domain of normalization and CI (a higher value of which indicates a higher degree of traffic congestion). If two segments are selected from two routes, their physical cross-section has to exist and the traffic flow direction has to be the same. In addition, their Norm and CI must have the same nature or characteristics.

CLAIMS:-

1. A method of providing traffic-related data including the steps of:-

    (a) obtaining data of events occurring at a plurality of locations along at least one traffic route;

    (b) processing said data; and

    (c) providing the processed data to at least one end user.

2. A method according to Claim 1 wherein said data include at least a first component indicating the time at which said events occur.

3. A method according to Claim 1 or 2 wherein said events include the time of departure of a transportation vehicle from one of said plurality of locations.

4. A method according to Claim 1 wherein said events include the time of arrival of a transportation vehicle at one of said plurality of locations.

5. A method according to Claim 3 or 4 wherein said data include at least a second component indicating the identity of the transportation vehicle(s) occasioning said event(s).

6. A method according to Claim 3, 4 or 5 wherein said data include at least a third component indicating the location at which said event(s) occur(s).

7. A method according to Claim 3 or 4 wherein said step (a) includes receiving signals from signal transmitting means associated with said transportation vehicle.

8. A method according to Claim 7 wherein said signal transmitting means includes an automatic vehicle locator.

9. A method according to Claim 7 or 8 further including the step of transmitting said signals to a data processing unit.

10. A method according to Claim 3 or 4 wherein said step (a) includes manually recording the time at which said events occur.

11. A method according to Claim 10 further including the step of transmitting data relating to said recorded time to a data processing unit.

12. A method according to Claim 9 or 11 wherein said data processing unit comprises a computer.

13. A method according to Claim 3 or 4 wherein said step (a) includes importation of data from at least one database.

14. A method according to any of the preceding claims further including the steps of storing said data.

15. A method according to any of the preceding claims wherein said step (b) includes grouping said data into a plurality of groups wherein each group comprises data of events occurring within a first pre-determined time period.

16. A method according to Claim 15 wherein each of said groups comprises data of events occasioned by a particular transportation vehicle.

17. A method according to any of the preceding claims wherein said step (b) includes calculating the time that elapses between the occurrence of a first event occasioned by a transportation vehicle at a first of said plurality of locations and the occurrence of a second event occasioned by the transportation vehicle at a second of said plurality of locations.

18. A method according to Claim 17 wherein said second of said plurality of locations is next succeeding to said first of said plurality of locations.

19. A method according to Claim 17 or 18 further including the step of obtaining a norm value of time that elapses between the occurrence of said first event occasioned by said transportation vehicle(s) at said first location and the occurrence of said second event occasioned by said transportation vehicle(s) at said second location over said first pre-determined time period.

20. A method according to Claim 19 wherein said step of obtaining said norm value includes normalizing the results of said calculation.

21. A method according to Claim 19 or 20 further including the step of obtaining a norm value of said norm values over a second pre-determined time period.

22. A method according to Claim 21 further including the step of generating a coefficient index relating to the occurrence of two events between two successive locations along said traffic route.

23. A method according to Claim 22 further including the step of generating, based on said coefficient index, a predictive time of occurrence of a future event at one of said locations along said traffic route.

24. A method according to any of the preceding claims wherein said step (c) includes providing said processed/generated data *via* a mobile phone system.

25. A method according to any of the preceding claims wherein said step (c) includes providing said processed/generated data by broadcasting.

26. A method according to any of the preceding claims wherein said step (c) includes

providing said processed/generated data to a database.

27. An apparatus for providing traffic-related data, including means for obtaining data of events occurring at a plurality of locations along at least one traffic route, means for processing said data, and means for providing the processed data to at least one end user.

28. An apparatus according to Claim 27 wherein said obtaining means includes signal receiving means for receiving signals transmitted from at least one transportation vehicle.

29. An apparatus according to Claim 27 wherein said obtaining means includes means for capturing sound and/or images.

30. An apparatus according to any one of Claims 27 to 29 wherein said processing means includes a data processing unit.

31. An apparatus according to Claim 30 wherein said data processing unit comprises a computer.

32. An apparatus according to any one of Claims 27 to 31 further including means for storing said data.

33. An apparatus according to any one of Claims 27 to 32 wherein said providing means includes broadcasting apparatus.