

DATE: Monday, May 14, 2007

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TO: File

RE: Task 5.5 – 2005 On-Board Survey Assignment & Analysis

On-Board Survey Assignment

A new on-board survey was performed between December 2005 and January 2006. The data from this survey is being used to refine the travel demand models so as to create forecasts for future transit ridership for the Honolulu High-Capacity Transit Corridor Project.

Data were collected using an innovative methodology that included the distribution of questionnaires to boarding passengers while simultaneously recording the boarding counts using GPS-enhanced palm devices. The Palm devices with GPS recorded the location and time (arrival and departure) at each bus stop. By entering questionnaire numbers into the units prior to arrival at a bus stop, this process also tied a sequence of questionnaires directly to a bus stop. This process allowed for expanding the data by route, time of day, direction, and bus stop (on) location. Previously surveys were only expanded by route, time of day, and direction. By adding bus stop location to the expansion process, the data will be more accurately represented since certain bus stop locations along a route had higher response rates than other locations (especially longer trips, see Figure 1).

The OMPO model considers 4 transit sub-modes; walk to local, walk to premium, park and ride, and kiss and ride, and two time periods; peak and off peak. Thus 8 trip tables were constructed for the 4 sub-modes and 2 time periods and these tables were assigned to their respective networks. The assignments were then combined to produce a daily transit assignment.

The transit trip tables were assigned using the same pathbuilding procedure used for skimming (see Table 1). Table 2 shows the bus speed factors used in the model. The resulting transit boardings by class of service are shown in Table 3.

Table 4 shows the resulting transit boardings by route for the observed 2005 boardings, 2005 assigned on-board survey boardings using the OLD (route, TOD, direction) expansion factor, and the 2005 assigned on-board survey boardings using the NEW (route, TOD, direction, bus stop on location) expansion factor. The 91% R^2 in Figure 2 shows that the goodness of fit is excellent and that the transfer penalty, and path parameters are reflecting what's being observed.

Table 1. Current Model Path Building Parameters

<i>Walk to Local/Limited Stop Bus</i>	
Walk Speed	3 MPH
Initial wait time factor	2
In-vehicle time factor for local bus	1
In-vehicle time factor for limited stop	0.9
Transfer Wait Time factor	2
Transfer Wait Time penalty	4 minutes
Maximum Perceived path time	300 minutes
<i>Walk to Express Bus</i>	
Walk Speed	3 MPH
Initial wait time factor	2
In-vehicle time factor	1.2
Bonus in-vehicle time factor for express bus	1.0
Transfer Wait Time factor	2
Transfer Wait Time penalty	4 minutes
Maximum Perceived path time	300 minutes
<i>Drive Access/Egress to Bus</i>	
Walk Speed	3 MPH
Maximum Drive Time	15 minutes
Initial wait time factor	2
In-vehicle time factor	1
Transfer Wait Time factor	2
Transfer Wait Time penalty	4 minutes
Maximum Perceived path time	300 minutes

**Note: The kiss and ride parameters were the same as the walk to local bus mode.

Table 2. Bus Speed Factors

Functional Class	Peak Factor	Off Peak Factor
Freeways / Expressways	1.0	1.0
Ramps	1.0	1.0
Arterial I	1.54	1.65
Arterial II	1.24	1.53
Arterial III	1.95	0.83
Collector I	1.22	1.50
Collector II	1.81	1.18
Local	0.83	1.41

Table 3. Transit Boardings by Class of Service

Class of Service	2005 Observed	2005 Year (OBS Assn) OLD EXPANSION FACTOR (ROUTE, TOD, DIRECTION)	2005 Year (OBS Assn) NEW EXPANSION FACTOR (ROUTE, TOD, DIRECTION, BUS STOP ON)	Percent Difference (New Expansion Factor Assignment / Observed)
Limited Stop	29,184	28,931	28,624	0.98
Urban Trunk	112,111	114,423	114,453	1.02
Suburban Trunk	62,159	56,172	56,920	0.92
Urban Feeder	12,943	8,866	9,906	0.77
Suburban Feeder	2,312	2,250	2,437	1.05
Community Circulator	9,573	7,485	7,257	0.76
Peak Express	8,291	8,568	8,008	0.97
Total	236,573	226,695	227,605	0.96

Table 4. Transit Boardings by Route Number

Class of Service	Route Number	2005 Observed	2005 Year (OBS Assn) OLD EXPANSION FACTOR (ROUTE, TOD, DIRECTION)	2005 Year (OBS Assn) NEW EXPANSION FACTOR (ROUTE, TOD, DIRECTION, BUS STOP ON)	Percent Difference (New Expansion Factor Assignment / Observed)
<i>Limited Stop Routes</i>					
1	A	15,429	19,183	19,782	0.83
1	B	7,443	3,629	3,264	0.64
1	C	6,312	6,119	5,578	1.09
<i>Subtotal</i>		<i>29,184</i>	<i>28,931</i>	<i>28,624</i>	<i>0.84</i>
<i>Urban Trunk Routes</i>					
2	1	21,096	25,996	25,127	1.07
2	2	19,863	19,254	20,424	0.93
2	3	12,435	13,928	13,943	1.03
2	4	9,827	8,042	7,687	0.68
2	5	1,557	1,492	1,383	0.92
2	6	6,635	6,669	6,247	1.54
2	8	9,254	3,827	3,707	0.37
2	9	10,121	7,053	6,795	0.70
2	13	13,423	17,024	16,972	1.15
2	19	5,357	4,883	5,347	1.00
2	20	2,543	6,255	6,821	2.60
<i>Subtotal</i>		<i>112,111</i>	<i>114,423</i>	<i>114,453</i>	<i>0.98</i>
<i>Suburban Trunk Routes</i>					
3	11	1,382	745	428	0.62
3	22	2,513	519	411	0.39
3	40	8,083	8,968	10,344	1.11
3	41	2,369	1,125	1,098	0.50
3	42	10,824	8,888	8,811	0.89
3	43	2,806	2,101	2,072	1.74
3	52	4,826	4,258	4,592	1.24
3	53	3,701	2,288	2,692	0.79
3	54	4,542	1,738	1,859	1.23
3	55	3,835	4,080	4,143	0.96
3	56	3,198	3,658	3,405	1.00
3	57	4,345	4,703	4,860	1.02
3	58	2,650	5,124	4,305	1.87
3	62	5,099	5,619	5,504	1.23
3	65	1,987	2,358	2,396	1.34
<i>Subtotal</i>		<i>62,159</i>	<i>56,172</i>	<i>56,920</i>	<i>1.07</i>

<i>Urban Feeder</i>					
4	7	3,929	3,552	4,326	1.13
4	10	692	226	395	0.92
4	14	1,823	2,110	2,508	1.42
4	15	928	575	425	0.86
4	16		61	95	
4	17	1,482	449	443	0.35
4	18	735	216	215	1.44
4	21	65	2	1	6.15
4	31	642	336	270	0.50
4	32	2,647	1,339	1,228	0.57
<i>Subtotal</i>		<i>12,943</i>	<i>8,866</i>	<i>9,906</i>	<i>0.95</i>
<i>Suburban Feeder</i>					
5	70	253	513	521	2.55
5	71		118	185	
5	72	494	463	332	0.83
5	73	870	621	836	0.53
5	74		82	77	
5	76	469	329	379	0.83
5	77	225	124	107	1.79
<i>Subtotal</i>		<i>2,312</i>	<i>2,250</i>	<i>2,437</i>	<i>1.14</i>
<i>Community Circulator</i>					
6	401	332	527	348	1.20
6	402	195	633	557	2.50
6	403	526	153	119	0.49
6	411	805	455	369	0.09
6	412	456	467	536	1.10
6	413	190	132	167	0.78
6	414		134	103	
6	415		28	21	
6	421	484	234	227	0.70
6	431	521	75	43	1.28
6	432	3,145	578	592	0.16
6	433	1,043	1,405	1,220	1.57
6	434	1,876	2,664	2,955	1.46
6	503		-	-	
<i>Subtotal</i>		<i>9,573</i>	<i>7,485</i>	<i>7,257</i>	<i>0.88</i>

<i>Peak Express</i>					
7	80	317	503	370	0.65
7	81	1,312	918	853	0.54
7	82		26	13	
7	83	593	1,026	1,230	1.38
7	84	485	548	480	1.02
7	85	460	55	44	0.28
7	86	18	53	20	1.00
7	88	336	269	224	0.72
7	89		41	65	
7	90	114	232	214	1.69
7	91	975	862	791	0.72
7	92	240	273	245	0.75
7	93	1,153	959	736	0.55
7	95		-	-	
7	96	156	127	128	0.78
7	97	408	575	601	0.89
7	98	210	9	20	0.30
7	101	405	608	589	0.94
7	102	180	203	158	0.99
7	103		82	86	
7	201	543	766	795	1.20
7	202	258	230	245	0.90
7	203	129	203	101	0.07
<i>Subtotal</i>		<i>8,291</i>	<i>8,568</i>	<i>8,008</i>	<i>0.79</i>
<i>Grand Total</i>		<i>236,573</i>	<i>226,695</i>	<i>227,605</i>	<i>0.98</i>

Figure 1. Trip Length Frequency Histogram Difference between New & Old Expansion Factor

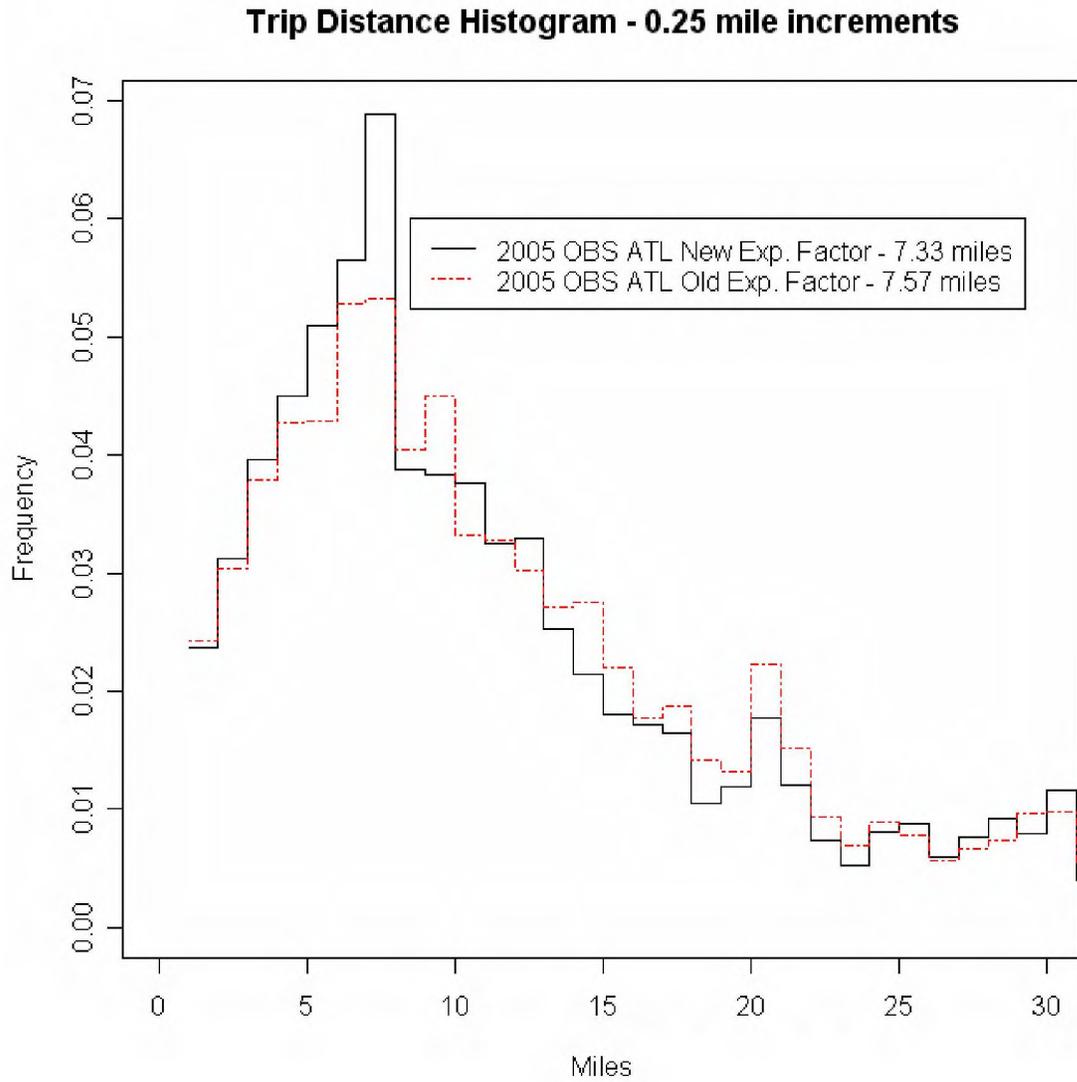


Figure 2. 2005 Observed Boardings and 2005 Estimated Boardings with On Board Survey Data for each Route

