SUPPORTING INFORMATION

Instance	Mode 1 (Mixed routes allowed)									Mode 2 (Mixed routes forbiden)					
	Integer solution	Lower Bound	Gap	Columns	CPU	Routes +	T	-	+-	Integer solution	Lower Bound	CPU	Routes +	T	-
2 hubs (*T3* and *T5*)															
r-101	Infeasible									Infeasible					
r-102	Infeasible									Infeasible					
r-103	1489.3	1372.6	4.24	2561	336.6	8	3	8	0	1534.2	1497.7	276.8	7	3	8
r-104	1474.5	1292.7	12.73	2823	916.7	5	3	4	4	1521.9	1467.3	605.5	7	3	8
r-105	1570.4	1425.3	2.65	1120	63.3	8	3	8	0	1624.4	1599.0	121.3	9	3	8
r-106	1533.3	1425.3	7.04	3330	611.3	6	3	6	2	1553.9	1527.4	250.4	8	3	7
r-107	1487.1	1387.0	6.73	3521	647.8	6	3	6	1	1523.3	1488.4	314.3	7	3	7
r-108	1471.7	1339.7	8.97	2360	674.0	6	3	6	1	1522.7	1431.6	509.7	8	3	7
r-109	1551.8	1399.4	9.82	2458	479.4	6	2	5	3	1588.3	1540.1	216.8	8	3	7
r-110	1458.1	1291.0	11.46	2240	615.0	5	2	5	2	1551.7	1512.2	292.6	7	3	8
r-111	1477.7	1328.5	10.10	2071	526.9	0	0	0	8	1515.6	1495.7	299.5	7	3	7
r-112	1460.0	1322.1	9.44	2289	1021.4	4	2	4	4	1490.2	1471.8	969.9	7	3	7
3 hubs (*T1*, *T3* and *T5*)															
r-101	1673.9	1511.1	9.72	2676	332.9	6	2	4	5	1696.8	1577.3	287.7	12	2	7
r-102	1579.1	1412.8	10.53	3789	689.8	6	1	5	3	1624.4	1458.4	437.5	9	3	8
r-103	1454.3	1230.0	12.06	3797	1190.1	4	1	4	4	1500.1	1356.3	670.8	7	1	7
r-104	1392.5	1241.8	11.67	4182	1674.3	3	1	3	5	1485.5	1331.3	1101.4	7	2	7
r-105	1524.1	1380.4	9.43	3127	508.1	5	1	4	4	1592.6	1310.5	442.6	9	2	7
r-106	1500.2	1339.2	10.73	2798	1649.3	3	2	4	5	1524.5	1374.2	630.7	7	2	8
r-107	1386.4	1246.7	10.08	2880	854.7	1	1	1	8	1468.6	1338.4	800.2	7	2	7
r-108	1399.1	1265.4	9.56	3073	1147.0	5	2	5	2	1469.3	1323.9	770.1	7	1	7
r-109	1507.9	1322.3	12.31	3075	649.0	6	2	6	2	1535.0	1381.8	415.8	8	2	7
r-110	1445.2	1257.8	12.97	3879	1201.1	4	1	4	3	1506.1	1359.4	552.0	7	1	7
r-111	1437.2	1270.0	11.64	2855	921.3	2	1	2	6	1468.8	1339.6	591.7	7	2	7
r-112	1401.5	1227.8	12.39	3068	1661.2	3	1	3	5	1478.8	1332.7	873.7	7	2	8
4 hubs (*T1*, *T2*, *T4* and *T5*)															
r-101	1690.0	1462.4	13.47	3752	517.3	6	2	4	5	1763.3	1567.4	306.9	11	4	8
r-102	1520.8	1344.5	11.59	3197	1500.6	4	2	3	6	1658.2	1438.5	405.5	10	3	8
r-103	1546.9	1243.1	19.64	5184	1054.5	2	1	2	8	1535.6	1294.2	784.5	7	3	7
r-104	1373.0	1172.2	14.64	4630	1726.2	1	1	1	7	1498.3	1271.7	801.1	7	3	7
r-105	1490.2	1295.7	13.05	4719	733.2	0	0	0	10	1623.7	1361.2	515.7	9	3	7
r-106	1491.6	1215.5	18.51	5729	1056.6	2	1	1	8	1589.3	1302.0	739.6	7	3	8
r-107	1432.9	1310.8	8.52	3468	958.6	6	2	4	4	1558.8	1279.8	866.1	7	3	8
r-108	1319.8	1147.3	13.09	3986	1202.9	1	1	1	7	1542.8	1264.2	1372.1	7	3	8
r-109	1435.4	1196.9	16.61	4321	857.7	2	1	2	7	1599.9	1304.2	1041.2	8	3	7
r-110	1343.4	1155.2	14.01	6032	2181.6	0	0	0	8	1449.5	1075.1	5792.8	6	3	4
r-111	1336.3	1167.7	12.62	4457	1418.8	0	0	0	8	1331.3	1053.4	5430.6	6	2	4
r-112	1414.0	1159.0	18.03	3760	2248.2	2	1	2	7	1506.3	1069.1	8711.5	6	0	5

Table S1. Comparison of results for 25 request (50 locations) instances on several terminals-network configurations

Instance	Integer solution	Lower Bound	Gap	Columns	CPU	Routes			
						+	T	-	+-
Scenario A									
r-101	4423.9	4417.2	0.15	1494	584.9	38	5	12	1
r-102	4208.2	4184.1	0.57	2022	776.6	35	5	12	0
r-103	4151.9	4139.3	0.30	1915	1055.4	34	5	12	0
r-104	2977.4	2847.3	4.37	3522	1231.6	16	11	13	1
r-105	3142.0	3061.8	2.55	2835	814.2	19	11	13	1
r-106	3068.0	2959.7	3.53	3051	939.7	17	12	12	1
r-107	2973.9	2855.4	3.99	3056	1139.4	14	11	14	1
r-108	2963.4	2802.4	5.43	3382	1351.0	14	11	13	2
r-109	3035.0	2950.7	2.78	3447	911.4	16	11	13	1
r-110	3009.9	2880.3	4.31	3609	1006.4	17	11	13	1
r-111	2969.0	2885.1	2.83	3227	1167.3	15	12	12	0
r-112	2934.9	2789.7	4.95	3969	1371.9	14	10	11	3
Scenario B									
r-101	4238.8	4185.5	1.26	3517	994.9	39	4	12	0
r-102	4007.3	3975.3	0.80	3980	1394.3	35	4	12	0
r-103	3969.8	3928.1	1.05	4082	1679.3	34	4	12	0
r-104	2705.0	2429.0	10.20	7019	2190.4	12	10	13	2
r-105	2906.2	2696.9	7.23	4246	901.7	16	8	13	3
r-106	2800.4	2566.3	8.33	4694	1254.9	14	9	11	3
r-107	2758.2	2519.3	8.66	7489	1937.6	13	10	11	2
r-108	2716.0	2478.0	8.78	6931	2226.2	12	9	10	2
r-109	2837.4	2631.7	7.25	6065	1530.1	12	12	10	2
r-110	2786.5	2497.1	10.39	5185	1255.7	13	11	12	2
r-111	2793.5	2547.2	8.81	5503	1661.5	13	12	11	0
r-112	2710.1	2491.5	8.06	7012	2642.1	12	12	10	2
Scenario C									
r-101	4219.0	4183.5	0.84	3069	1124.3	39	4	11	0
r-102	3996.1	3970.1	0.65	3387	1571.0	35	4	11	0
r-103	3957.0	3921.9	0.89	3270	2033.7	34	4	11	0
r-104	2637.8	23482	10.98	7615	2661.5	11	11	10	2
r-105	2851.0	2539.9	10.91	5070	1741.1	15	12	13	0
r-106	2736.1	2412.7	11.59	7312	2455.4	13	12	13	0
r-107	2634.8	2373.3	11.67	7540	3253.8	11	12	13	0
r-108	2632.2	2263.0	14.03	6496	3357.8	11	12	9	2
r-109	2728.6	2415.0	11.49	6239	2063.1	11	11	11	2
r-110	2680.6	2345.2	12.51	5773	2295.3	12	11	10	1
r-111	2675.6	2340.6	12.52	6709	3131.9	14	10	10	1
r-112	2627.1	2321.5	11.63	7867	3389.6	11	12	11	1

Table S2. Results for the 50 requests (100 locations) instances in the scenarios with a growing level of overlapping between the service areas

Pick-up stage					
Terminal	Tour	Load collected	Tour cost	Return time	Unload entime
T1	T1-r27-r28-r2-r21-r26-T1	67	84.2	181.2	258.2
	T1-r31-r19-r30-r1-T1	75	106.6	201.6	286.6
T2	T2-r40-T2	9	71.0	84.5	103.5
	T2-r16-r44-r14-r37-T2	65	52.9	161.9	236.9
	T2-r5-r6-r18-r8-r45-r17-T2	68	90.2	208.2	286.2
	T2-r38-r43-r15-r42-r13-T2	59	102.8	215.7	284.7
T3	T3-r7-r10-r11-r48-T3	69	67.9	207.8	286.8
	T3-r47-r49-r36-r46-T3	63	75.5	183.3	256.3
T4	T4-r9-r34-r35-r20-r32-T4	70	105.5	241.4	321.4
	T4-r33-r29-r3-r12-r50-T4	65	75.8	191.1	266.1
T5	T5-r41-r39-r25-r24-r4-T1	64	101.4	223.1	297.1

Transfer stage				
Crossdocking operations	Transfer time	Requests moved	Load moved	Cost
T1	286.6	r2-r19-r1	34	40.0
T2	286.2	r44-r45-r43-r42	46	40.0
T4	266.1	r29	9	40.0
T5	297.1	r25-r24-r4	28	40.0

Long-haul routes	Transfer time start	Transfer time end	Requests transferred		
T1-T4	286.6	302.4	r27-r28-r21-r26-r31-r30	87	71.8
T2-T3	286.2	308.7	r40-r14-r37-r38-r13	76	85.0
T2-T4	286.2	320.8	r16-r18-r15	39	109.1
T2-T5	286.2	312.5	r5-r6-r8-r17	40	92.5
T3-T2	286.3	308.7	r7-r10-r11-r48-r47-r49-r36-r46	132	85.0
T4-T1	321.4	337.3	r20-r32-r3-r12	64	71.8
T4-T2	321.4	356.0	r9-r34-r35-r33-r50	62	109.1
T5-T2	297.1	323.3	r2-r41-r39	36	92.5

Delivery stage					
Terminal	Departure time	Tour	Load to deliver	Tour cost	Return time
T1	495.8	T1-r3-T1	13	28.9	527.8
	341.7	T1-r2-r32-r12-r20-r19-T1	75	92.5	439.1
T2	533.7	T2-r49-r39-T2	61	57.2	651.9
	357.6	T2-r9-r46-r10-r33-r34-r11-r36-T2	75	78.2	547.7
	344.5	T2-r50-r7-r37-r45-r44-r43-r35-T4	75	69.5	558.2
	400.3	T2-r41-r47-r42-r48-T2	73	41.6	654.4
T3	425.2	T3-r38-r40-r13-r14-T3	68	92.9	640.2
T4	517.3	T4-r31-T4	27	32.8	567.1
	359.0	T4-r29-r28-r21-r15-r16-r1-T4	73	96.4	568.4
	422.0	T4-r27-r18-r30-r26-T4	66	51.3	559.3
T5	364.0	T5-r8-r24-r25-r6-r17-r5-r4-T5	68	113.3	595.4

Mixed routes				
Terminal	Tour	Maximum onboard load	Tour cost	Return time
T5	T5-r23^{+}-r22^{+}-r23^{-}-r22^{-}-T5	47	62.2	642.0

$^{+}$Pickup stops $^{-}$Delivery stops

Table S3. The solution for the instance R-112 in Scenario C

Costs	
Pick-up routes	933.8
Cross-docking operations	160.0
Long-haul routes	716.8
Delivery routes	754.3
Pick-up and delivery routes	62.2
Total	2627.1

Table S4. Costs involved in the fulfillment of the solution to the instance R-112 in Scenario C

Appendix

Urban coordinates of depots for the case study

Terminal	Central depot	Secondary *S Tomé* depot
	X_{coord} = 250 ; X_{coord} = 620;	X_{coord} = 0; X_{coord} = 0;

Table S4.b.

Transportation requests datasheet

Request	Cargo Volume (m^3)	Pick-up				Delivery			
		X_{coord}	Y_{coord}	t_i^{min} (')*	t_i^{max}(')*	X_{coord}	Y_{coord}	t_i^{min} (')*	t_i^{max} (')*
n7	0.5	207	503	60	120	72	-46	-	720
n8	1.0	107	734	-	210	347	246	-	720
n9	1.5	557	603	90	150	302	226	-	720
n10	1.5	307	603	120	180	262	326	-	720
n11	1.2	207	653	-	210	212	226	-	720
n12	2.0	507	353	-	210	227	566	-	720
n13	2.5	307	253	-	210	257	676	-	720
n14	2.0	27	-49	-	210	137	756	-	720
n15	1.0	27	-49	-	210	607	756	-	720
n16	2.0	212	203	-	210	477	716	-	720
n17	0.2	162	303	-	210	337	-116	-	720
n18	1.2	207	403	30	150	547	376	-	720
n19	2.0	157	603	-	210	357	456	-	720
n20	1.0	457	653	-	210	357	546	-	720
n21	1.2	457	203	-	210	557	666	-	720
n22	1.8	27	-49	-	210	222	-06	-	720
n23	3.0	27	-49	-	210	427	156	-	720
n24	0.3	657	353	-	210	212	-36	-	720
n25	0.5	572	203	-	210	242	-56	-	720
n26	1.5	457	303	150	210	477	406	-	720
n27	1.5	357	403	-	210	517	416	-	720
n28	2.0	417	373	-	210	616	506	-	720
n29	1.0	635	423	-	210	576	466	-	720
n30	2.5	395	603	30	150	566	356	-	720
n31	3.0	305	523	-	210	556	526	-	720
n32	2.5	345	681	-	210	156	474	-	720
n33	1.2	525	511	150	210	146	675	-	720
n34	1.5	645	541	-	210	221	314	-	720
n35	0.8	625	641	-	210	271	224	-	720
n36	1.5	15	892	-	210	151	184	-	720
n37	1.0	300	191	-	210	286	184	-	720
n38	2.0	-85	-111	-	210	266	524	-	720
n39	3.5	275	-41	120	180	266	354	-	720
n40	1.0	395	241	-	210	316	674	-	720
n41	0.5	180	-91	-	210	261	194	-	720
n42	0.5	00	-41	60	120	226	224	-	720
n43	0.5	-10	-131	-	120	291	244	-	720
n44	2.0	-25	-21	-	120	266	274	-	720
n45	2.0	55	672	-	210	256	244	-	720
n46	0.2	15	772	-	210	226	274	-	720
n47	3.0	75	847	-	120	256	214	-	720
n48	3.5	125	807	90	150	301	214	-	720
n49	3.0	55	666	-	210	206	264	-	720
n50	1.0	465	456	-	210	291	184	-	720

Distances between locations are estimated as: $d_{ij} = 0.03*(| X^i_{coord} - X^j_{coord} | + | Y^i_{coord} - Y^j_{coord}|)$

* t = 0' corresponds to 8:00AM. The campaign ends at t = 720' = 8:00PM

Table S4.b.