5.6 General Plan

1) Main Characteristics of General Plan

5.54 General Plan has been drafted based on the concept and consideration of the existing projects (see Figure 5.6.1). Main characteristics are as follows:

(i) Green system comprising sea water, rivers, lakes and ponds, forest, rural agriculture lands, parks as well as streets with rich trees form foundation of the city. They are adequately connected and form a green network of the city.

(ii) Mass–transit network provides another foundation for safe and smooth movement of the people and to reduce traffic conflict and congestions on roads. In order farther to enhance the effects of transit systems, integrated land use / urban developments are associated along the corridor.

(iii) Residential areas to provide housing for the people need to be reorganized to accommodate urban population effectively in medium to high–density. For this adequate types of collective apartments need to be provided, rather than individual detached housing.

(iv) Industrial areas will be basically allotted to the area along national / regional transport corridors to ensure smooth distribution of goods and avoid conflict from the mixture of urban and inter–city traffic.

5.55 Key elements incorporated in formulating General Plan are farther as follows:

(i) **Urban Center:** Historically, the urban center of Danang has been around the Danang People Committee Building and Han Market. Many companies establish their offices around the area. The area of this central urban center will expand to more than twice of current area. A part of Ngu Hanh Son District will be integrated into the central urban area by two new bridges over the Song River. At the same time, many people will remain to live in the area.

(ii) **Urban Subcenters:** In additional to the above urban center, two subcenters are to be constructed. One is in Lien Chieu District and it is based on the new station of high-speed and ordinary railways. It will also have a bus terminal. The other urban subcenter will be newly constructed in the southern area of Ngu Hanh Son District. This is a gateway to the south. With a new campus of Danang University, this urban subcenter will be constructed as academic and technology subcenter. New urban subcenter location is carefully selected on the “suitable land.”

(iii) **Location of Airport:** Discussions on existing Danang Airport is summarized in Section 6.3. Scenario 3 assumes Danang Airport will stay in the current location and Nuoc Man Airport will not be used in 2025.

(iv) **Inter-City Transportation Network:** There are some projects of new national transportation system. One is North-South High Speed Railway (HSR) and North-South Expressway. The former will be introduced to the existing urban area with one station. The latter, however, will follow a route along existing National Route 1A bypass.

(v) **Transportation Facility:** Tian Sa Seaport will continue to be the most important deep sea port. Lien Chieu port is based on the Danang’s plan. Two subcenters will have own bus terminals.

(vi) **Industrial Zones:** DaCRISS will follow the Danang's plan of industrial zones except existing Danang Industrial Zone. Thus, seven major industrial areas are to be prepared to promote industrial development. The locations are mostly in the fringe or outside of urban area and are selected with careful environmental consideration.

(vii) **Preservation of Water Front Area:** My Khe coastal area is reserved for tourism development and conceded to various investors of domestic and foreign. Preservation of this area is critical for tourism industry development in Danang. In addition, Han Riverside landscape is another important tourism resource. The land use is prepared to preserve these water front areas.

(viii) **Park and Green Space:** The current park and green space is very limited in the central area of Danang. Smaller community parks are included in the residential areas. The land use plan proposes open space stain the low land of Hoa Xuan District. This area is too low for residential development.

(ix) **Prototype of Residential Development:** Mixed use of residential and commercial is becoming a tradition of modern Vietnamese Cities. DaCRISS also proposes the residential development by the middle ranged population density, which is around 250 person per hectare. There will be some exception for the area close to the landing zone of airport and special area for suburban-type residential development.

Figure 5.6.1 General Plan

Source: DaCRISS Study Team.

2) Land Use Classification

(a) **Land Use Zoning System:** Land use zoning is a commonly practiced institutional arrangement to regulate the use of lands in many countries. New urban planning law which is expected to be effective in 2010 also stipulate introduction of zoning system for the first time in Vietnam, though details are yet to be worked out. This has been discussed in HAIDEP and a land use zoning system was proposed as follows (see Table 5.6.1).

Table 5.6.1 Proposal on Land Use Zoning Guide for General Plan

	Subzone
I – Rural	Agricultural Land
	Rural Residential
	Rural Service Center
II – Residential	Low Density Residential
	Medium Density Residential
	High Density Residential
III – Commercial and Business	Commercial and Business Center
	Corridor Commercial
	District Commercial
	Tourism
IV – Public Use	District / Neighborhood Public Amenity
	Higher Education and Training
	Military
	Cemetery
V – Industrial	Light Industry
	High Tech Park
VI – Green & Open Space	Water Body
	Natural Openspace (buffer area, forest)
	Urban Openspace (park, square, beach, waterfront)
	Natural Preserved Area

Source: Revised for DaCRISS based on HAIDEP

(b) **Proposed Land Use Plan:** On the basis of discussions held in foregoing sections, future land use plan was prepared (see Figure 5.5.2). Main characteristics of the plan are as follows:

(i) Lands for urban use were allocated in the areas suitable for development based on development suitability analysis. Environmentally sensitive areas including coastal areas, forest areas, mountain areas as well as water areas were carefully treated to avoid damage to ecosystems and disasters as well as to preserve quality environment.

(ii) In order to promote compact city development, medium to high density use of lands, especially in the existing and new city centres along mass–transit corridors is encouraged.

(iii) In general, mixed use of urban lands is allowed, though specific types of developments / buildings are farther defined to avoid conflict and degradation of environment.

(iv) In principle, urban lands will be located between the areas with certain distance setback from the coastline in the north and east, and national / regional transport network in the west.

3) Urban Land Use Plan

5.56 Based on the above policy, the major function of the city is laid out and the proposed land use classification is applied (see Table 5.6.2).

Table 5.6.2 Area by Land Use by District

	Hai Chau	Thanh Khe	Son Tra	Ngu Hanh Son	Cam Le	Lien Chieu	Hoa Vang	Total
Agricultural Land	0	0	0	0	100	0	9,683	9,783
Rural Residential	0	0	0	0	0	0	1,489	1,489
Cemetery	0	0	0	0	0	0	350	350
Low Density Residential	0	0	518	388	394	169	654	2,123
Medium Density Residential	38	0	305	742	381	1,135	1,695	4,297
High Density Residential	0	33	369	616	0	206	230	1,454
Existing Residential	1,090	746	0	0	908	288	0	3,032
Central Business District	58	31	100	194	0	113	0	495
District Commercial	0	0	24	37	29	67	127	285
Public Amenity	0	0	12	29	0	19	25	84
Key Utility	643	75	60	103	21	149	0	1,051
Basic Education	0	0	38	52	5	35	40	171
Higher Education and Training	0	0	0	0	214	0	0	214
Military	0	0	0	0	206	53	0	260
Warehouse land	0	0	0	0	0	96	25	121
Industrial Area	0	0	0	0	0	814	100	914
Quasi Industrial	0	0	0	0	0	0	1,154	1,154
Park and Green Space	131	0	1,385	553	245	1,826	5,013	9,152
Tourism and Recreation	7	0	160	345	0	217	401	1,130
Forest	0	0	2,655	0	63	2,344	50,571	55,632
Water Front	69	0	107	321	528	401	1,143	2,571
Total	2,035	885	5,732	3,380	3,094	7,931	72,702	95,760

Source: DaCRISS Study Team.

4) Correspondence of Socio-Economic Characteristics with Spatial Plan

(a) **Population Density and Daytime–Nighttime Ratio:** Daytime–nighttime ratio is especially high in all areas that have industrial zones and CBDs, centering employment in the daytime. It is also high in the university area in Ngu Hanh Son, centering students in the daytime (see Figure 5.6.2).

(b) **Distribution of Daytime Workers:** Workers at primary sector (i.e. agriculture, forestry, and fishery) are distributed in proportion to the agricultural land based on the current land use, with presupposition that agricultural land use will not increase in the future. Given the situation that the city is of mixed land use, secondary workers are distributed in proportion to the total population of each commune. Workers at the secondary sector are also distributed based on the location of industrial areas. Likewise in the tertiary sector, given the situation that the city is of mixed land use, tertiary workers are distributed in proportion to the total population of each commune. Workers at the tertiary sector are also distributed based on the location of CBDs (see Figure 5.6.3 and 5.6.4).

(c) **Distribution of Daytime Students:** Students at primary and secondary educational level are distributed proportionately to the population density. Daytime population of tertiary educational level students is concentrated in the university area in Ngu Hanh Son (see Figure 5.6.3 and 5.6.5).

Table 5.6.3 Population Density in Scenario 3 by Commune

HIS ID	Commune / District	Area (ha)		Population Density (no / ha)				Population		
		Gross	Net[1)]	2007		2025		no		Growth (07-25)
				Gross	Net[1)]	Gross	Net[1)]	2007	2025	
1	P. Binh Hien	50	37	254	346	267	364	12,782	13,462	0.3
2	P. Binh Thuan	52	46	289	327	300	340	14,894	15,477	0.2
4	Hoa Thuan Tay	844	119	16	112	20	140	13,322	16,659	1.2
13	Hoa Thuan Dong	108	70	141	217	177	271	15,257	19,079	1.2
5	P. Hai Chau I	92	71	159	207	135	176	14,615	12,409	-0.9
6	P. Hai Chau II	35	35	398	398	321	321	14,114	11,366	-1.2
7	Hoa Cuong Bac	350	269	58	75	71	92	20,148	24,891	1.2
3	Hoa Cuong Nam	213	179	55	66	68	81	11,787	14,562	1.2
8	P. Nam Duong	24	24	470	470	598	598	11,250	14,305	1.3
9	P. Phuoc Ninh	54	36	246	367	252	377	13,365	13,703	0.1
10	P. Thanh Binh	75	74	260	262	199	201	19,545	14,945	-1.5
11	P. Thuan Phuoc	111	63	143	250	173	301	15,850	19,082	1.0
12	P. Thach Thang	102	86	178	211	190	225	18,180	19,387	0.4
Hai Chau		2,110	1,111	92	176	99	188	195,109	209,326	0.4
15	P. Chinh Gian	74	74	273	273	305	305	20,325	22,704	0.6
16	P. Tam Thuan	50	50	380	380	393	393	19,050	19,687	0.2
18	P. Thac Gian	78	66	240	284	278	328	18,653	21,547	0.8
19	P. Tan Chinh	37	37	439	439	502	502	16,229	18,581	0.8
20	P. Vinh Trung	52	50	363	373	371	382	18,692	19,120	0.1
21	P. Xuan Ha	83	83	212	212	142	142	17,669	11,857	-2.2
14	P. An Khe	211	100	87	183	123	259	18,351	25,912	1.9
22	P. Hoa Khe	141	140	94	95	133	134	13,204	18,645	1.9
23	Thanh Khe Tay	119	119	117	117	139	139	13,903	16,590	1.0
17	Thanh Khe Dong	82	82	136	136	162	162	11,213	13,380	1.0
Thanh Khe		927	802	180	209	203	234	167,289	188,023	0.7
24	P. An Hai Bac	349	329	66	70	149	158	23,178	51,977	4.6
25	P. An Hai Tay	106	71	139	206	64	95	14,692	6,810	-4.2
26	P. An Hai Dong	81	81	201	201	196	196	16,300	15,863	-0.2
27	P. Man Thai	107	107	124	124	169	169	13,259	18,083	1.7
28	P. Nai Hien dong	420	372	35	40	151	171	14,856	63,545	8.4
29	P. Phuoc My	204	204	75	75	97	97	15,250	19,807	1.5
30	P. Tho Quang	4,750	1,331	5	17	12	45	22,435	59,291	5.5
Son Tra		6,017	2,810	20	43	39	84	119,970	235,377	3.8
31	My An	411	373	43	47	110	121	17,595	45,234	5.4
34	Khue My	471	431	18	20	117	127	8,660	54,896	10.8
32	P. Hoa Hai	1,356	1,300	12	13	106	111	16,363	143,761	12.8
33	P. Hoa Quy	1,417	1,181	8	10	89	106	11,449	125,748	14.2
Ngu Hanh Son		3,655	3,321	15	16	101	111	54,067	369,640	11.3
36	Hoa Phat	611	531	17	19	95	109	10,263	57,898	10.1
35	Hoa An	309	302	44	45	153	157	13,476	47,306	7.2
37	Hoa Tho Tay	847	615	10	13	29	40	8,053	24,413	6.4
38	Hoa Tho Dong	254	223	39	45	172	195	9,985	43,612	8.5
39	Hoa Xuan	990	779	11	14	48	61	11,160	47,154	8.3
40	P. Khue Trung	311	267	49	58	160	187	15,383	49,836	6.7
Cam Le		3,322	2,749	21	25	81	98	68,320	270,220	7.9
44	Hoa Hiep Bac	4,576	2,090	3	6	8	17	12,308	35,439	6.1
41	Hoa Hiep Nam	796	720	19	21	91	100	15,428	72,069	8.9
45	Hoa Khanh Bac	1,090	866	26	33	62	78	28,756	67,187	4.8
42	Hoa Khanh Nam	1,049	747	13	19	67	94	13,918	70,287	9.4
43	P. Hoa Minh	797	778	31	32	148	152	24,679	118,075	9.1
Lien Chieu		8,308	4,916	11	19	44	74	95,089	363,056	7.7
46	Hoa Bac	33,864	70	0	48	0	48	3,347	3,347	0.0
47	Hoa Chau	985	922	12	12	93	99	11,377	91,195	12.3
48	Hoa Khuong	4,211	1,069	3	10	5	18	10,587	19,472	3.4
49	Hoa Lien	3,820	1,964	3	6	28	54	11,034	105,192	13.3
50	Hoa Nhon	2,920	712	4	18	4	18	12,774	12,774	0.0
51	Hoa Ninh	10,105	552	0	8	2	40	4,384	22,220	9.4
52	Hoa Phong	1,810	1,564	8	9	11	13	13,784	19,782	2.0
53	Hoa Phu	8,586	371	1	12	1	21	4,373	7,675	3.2
54	Hoa Phuoc	712	670	14	14	88	94	9,674	62,798	11.0
55	Hoa Son	2,227	503	5	22	18	80	10,926	40,222	7.5
56	Hoa Tien	1,393	1,171	11	13	70	83	14,653	96,951	11.1
Hoa Vang		70,633	8,481	2	13	7	57	106,913	481,628	8.7
Danang City		94,972	25,043	8	32	22	85	806,757	2,117,269	5.5

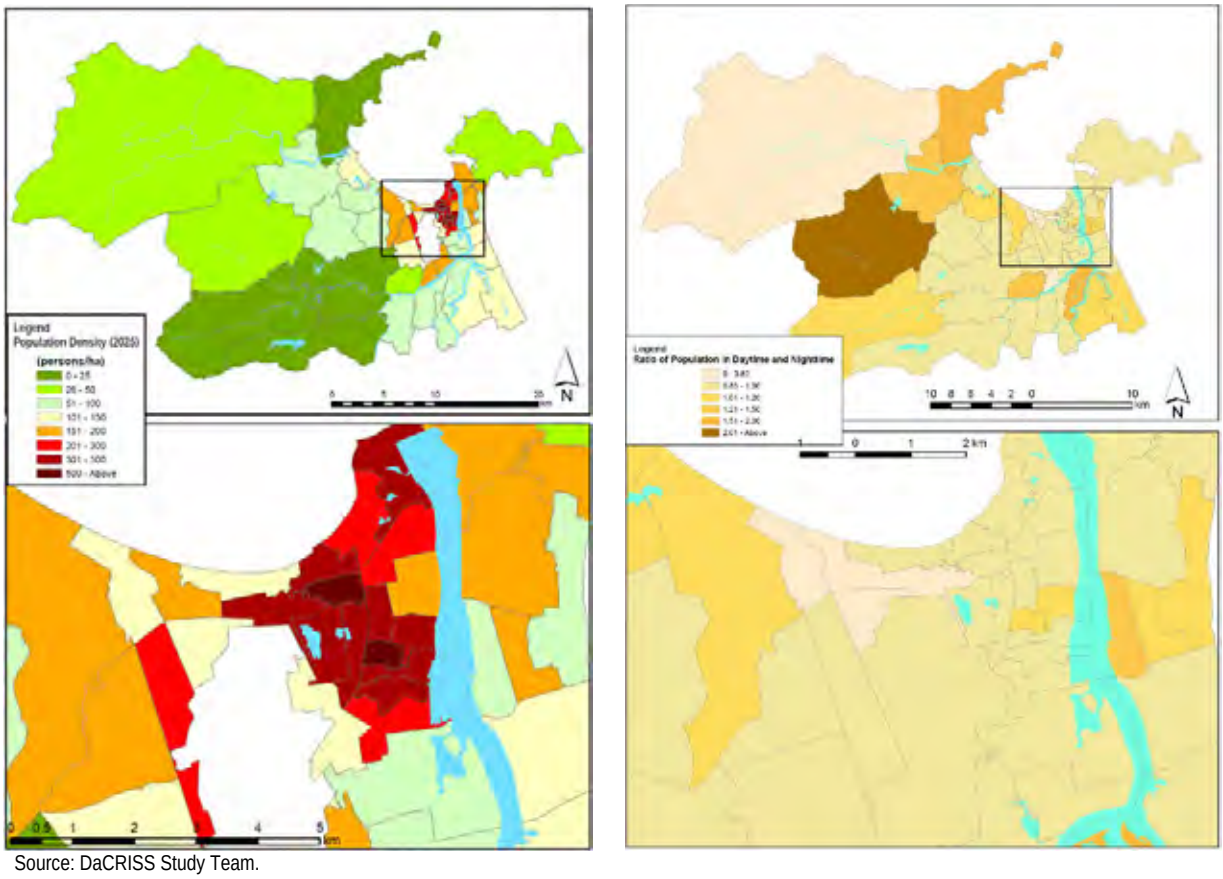
Source: GSO for 2007 data, DaCRISS Study Team for 2025 data.

Table 5.6.4 Distribution of Daytime Workers and Students in Scenario 3 by Commune

HIS ID	Commune / District	Population	Employment at Workplace				Student at Schoolplace				Net Density (no/ha) [1]		
			1	2	3	Total	1	2	3	Total	Pop	Employ	Student
1	P. Binh Hien	13,462	0	692	2,835	3,527	918	1,423	0	2,340	364	95	63
2	P. Binh Thuan	15,477	0	796	2,200	2,997	1,055	1,636	0	2,691	340	66	59
4	Hoa Thuan Tay	16,659	0	857	2,371	3,228	1,136	1,760	0	2,896	140	27	24
13	Hoa Thuan Dong	19,079	0	981	2,712	3,694	1,301	2,016	0	3,317	271	53	47
5	P. Hai Chau I	12,409	0	638	1,764	2,403	846	1,311	0	2,157	176	34	31
6	P. Hai Chau II	11,366	0	585	2,405	2,990	775	1,201	0	1,976	321	84	56
7	Hoa Cuong Bac	24,891	0	1,280	3,539	4,819	1,697	2,630	0	4,327	92	18	16
3	Hoa Cuong Nam	14,562	0	749	2,070	2,819	993	1,539	0	2,532	81	16	14
8	P. Nam Duong	14,305	0	736	4,959	5,695	975	1,512	0	2,487	598	238	104
9	P. Phuoc Ninh	13,703	0	705	5,953	6,658	934	1,448	0	2,382	377	183	66
10	P. Thanh Binh	14,945	0	769	2,125	2,893	1,019	1,579	0	2,598	201	39	35
11	P. Thuan Phuoc	19,082	0	982	3,069	4,050	1,301	2,016	0	3,317	301	64	52
12	P. Thach Thang	19,387	0	997	2,756	3,754	1,322	2,049	0	3,370	225	44	39
	Hai Chau	209,326	0	10,768	38,759	49,527	14,271	22,120	0	36,391	188	45	33
15	P. Chinh Gian	22,704	0	1,168	3,228	4,396	1,548	2,399	0	3,947	305	59	53
16	P. Tam Thuan	19,687	0	1,013	2,799	3,812	1,342	2,080	0	3,423	393	76	68
18	P. Thac Gian	21,547	0	1,108	5,580	6,689	1,469	2,277	0	3,746	328	102	57
19	P. Tan Chinh	18,581	0	956	2,642	3,598	1,267	1,964	0	3,230	502	97	87
20	P. Vinh Trung	19,120	0	984	4,835	5,818	1,304	2,020	0	3,324	382	116	66
21	P. Xuan Ha	11,857	0	610	1,686	2,296	808	1,253	0	2,061	142	28	25
14	P. An Khe	25,912	0	1,333	3,790	5,123	1,767	2,738	0	4,505	259	51	45
22	P. Hoa Khe	18,645	0	959	2,651	3,610	1,271	1,970	0	3,241	134	26	23
23	Thanh Khe Tay	16,590	0	853	2,359	3,212	1,131	1,753	0	2,884	139	27	24
17	Thanh Khe Dong	13,380	0	688	1,902	2,590	912	1,414	0	2,326	162	31	28
	Thanh Khe	188,023	0	9,672	31,471	41,143	12,818	19,869	0	32,687	234	51	41
24	P. An Hai Bac	51,977	0	2,674	9,970	12,643	3,544	5,492	0	9,036	158	38	27
25	P. An Hai Tay	6,810	0	350	3,965	4,315	464	720	0	1,184	95	60	17
26	P. An Hai Dong	15,863	0	816	7,025	7,841	1,081	1,676	0	2,758	196	97	34
27	P. Man Thai	18,083	0	930	2,668	3,599	1,233	1,911	0	3,144	169	34	29
28	P. Nai Hien dong	63,545	0	3,269	10,023	13,291	4,332	6,715	0	11,047	171	36	30
29	P. Phuoc My	19,807	0	1,019	9,974	10,993	1,350	2,093	0	3,443	97	54	17
30	P. Tho Quang	59,291	0	3,050	18,514	21,564	4,042	6,265	0	10,308	45	16	8
	Son Tra	235,377	0	12,108	62,139	74,247	16,047	24,873	0	40,919	84	26	15
31	My An	45,234	0	2,327	8,203	10,529	3,084	4,780	0	7,864	121	28	21
34	Khue My	54,896	0	2,824	11,261	14,084	3,743	5,801	0	9,544	127	33	22
32	P. Hoa Hai	143,761	0	7,395	58,638	66,033	9,801	15,191	2,759	27,751	111	51	21
33	P. Hoa Quy	125,748	0	6,468	32,651	39,120	8,573	13,288	26,944	48,805	106	33	41
	Ngu Hanh Son	369,640	0	19,014	110,752	129,766	25,200	39,060	29,703	93,964	111	39	28
36	Hoa Phat	57,898	0	2,978	9,941	12,920	3,947	6,118	0	10,065	109	24	19
35	Hoa An	47,306	0	2,433	7,497	9,930	3,225	4,999	0	8,224	157	33	27
37	Hoa Tho Tay	24,413	26	12,217	4,570	16,813	1,664	2,580	0	4,244	40	27	7
38	Hoa Tho Dong	43,612	0	2,243	6,200	8,444	2,973	4,609	0	7,582	195	38	34
39	Hoa Xuan	47,154	0	2,426	7,242	9,668	3,215	4,983	48,745	56,943	61	12	73
40	P. Khue Trung	49,836	0	2,564	7,085	9,649	3,398	5,266	0	8,664	187	36	32
	Cam Le	270,220	26	24,861	42,536	67,423	18,422	28,555	48,745	95,722	98	25	35
44	Hoa Hiep Bac	35,439	0	19,333	14,910	34,244	2,416	3,745	0	6,161	17	16	3
41	Hoa Hiep Nam	72,069	0	11,431	12,368	23,799	4,913	7,616	0	12,529	100	33	17
45	Hoa Khanh Bac	67,187	0	17,962	9,555	27,517	4,580	7,100	0	11,680	78	32	13
42	Hoa Khanh Nam	70,287	0	3,615	15,679	19,295	4,792	7,427	0	12,219	94	26	16
43	P. Hoa Minh	118,075	0	6,074	39,860	45,934	8,050	12,477	0	20,527	152	59	26
	Lien Chieu	363,056	0	58,415	92,373	150,788	24,751	38,365	0	63,116	74	31	13
46	Hoa Bac	3,347	1,890	172	476	2,538	228	354	0	582	48	36	8
47	Hoa Chau	91,195	0	4,691	17,941	22,632	6,217	9,637	32	15,886	99	25	17
48	Hoa Khuong	19,472	2,713	1,002	2,768	6,483	1,328	2,058	0	3,385	18	6	3
49	Hoa Lien	105,192	48	56,795	23,570	80,412	7,171	11,116	0	18,287	54	41	9
50	Hoa Nhon	12,774	3,789	657	1,816	6,262	871	1,350	0	2,221	18	9	3
51	Hoa Ninh	22,220	2,196	11,954	20,667	34,817	1,515	2,348	0	3,863	40	63	7
52	Hoa Phong	19,782	2,393	1,018	2,812	6,223	1,349	2,090	0	3,439	13	4	2
53	Hoa Phu	7,675	3,419	395	3,647	7,460	523	811	0	1,334	21	20	4
54	Hoa Phuoc	62,798	0	3,230	11,258	14,488	4,281	6,636	0	10,917	94	22	16
55	Hoa Son	40,222	1,467	2,330	8,360	12,156	2,742	4,250	0	6,993	80	24	14
56	Hoa Tien	96,951	818	4,987	21,878	27,683	6,610	10,245	0	16,855	83	24	14
	Hoa Vang	481,628	18,732	87,230	115,192	221,154	32,835	50,894	32	83,761	57	26	10
	Danang City	2,117,269	18,758	222,066	493,223	734,047	144,345	223,735	78,480	446,561	85	29	18

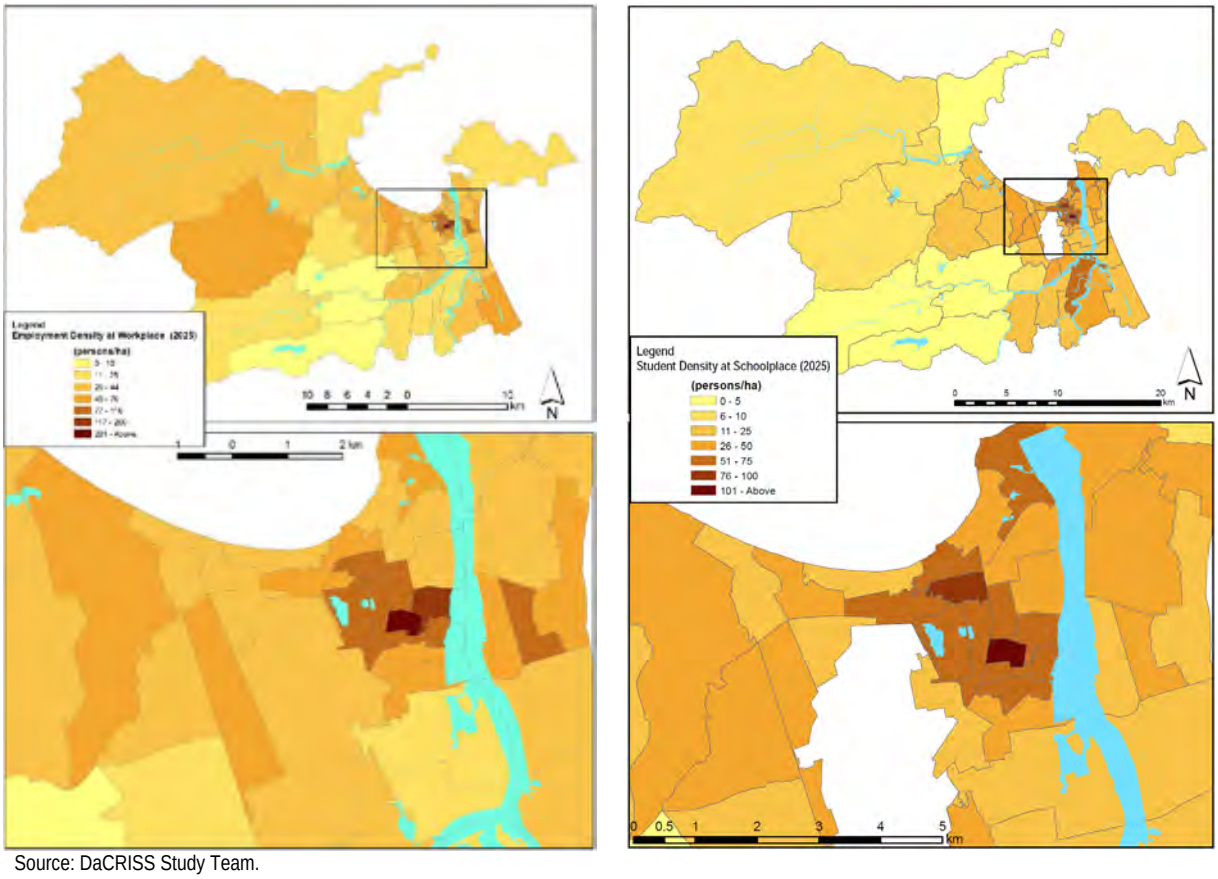
Source: DaCRISS Study Team.

Figure 5.6.2 Population Density and Daytime – Nighttime Ratio



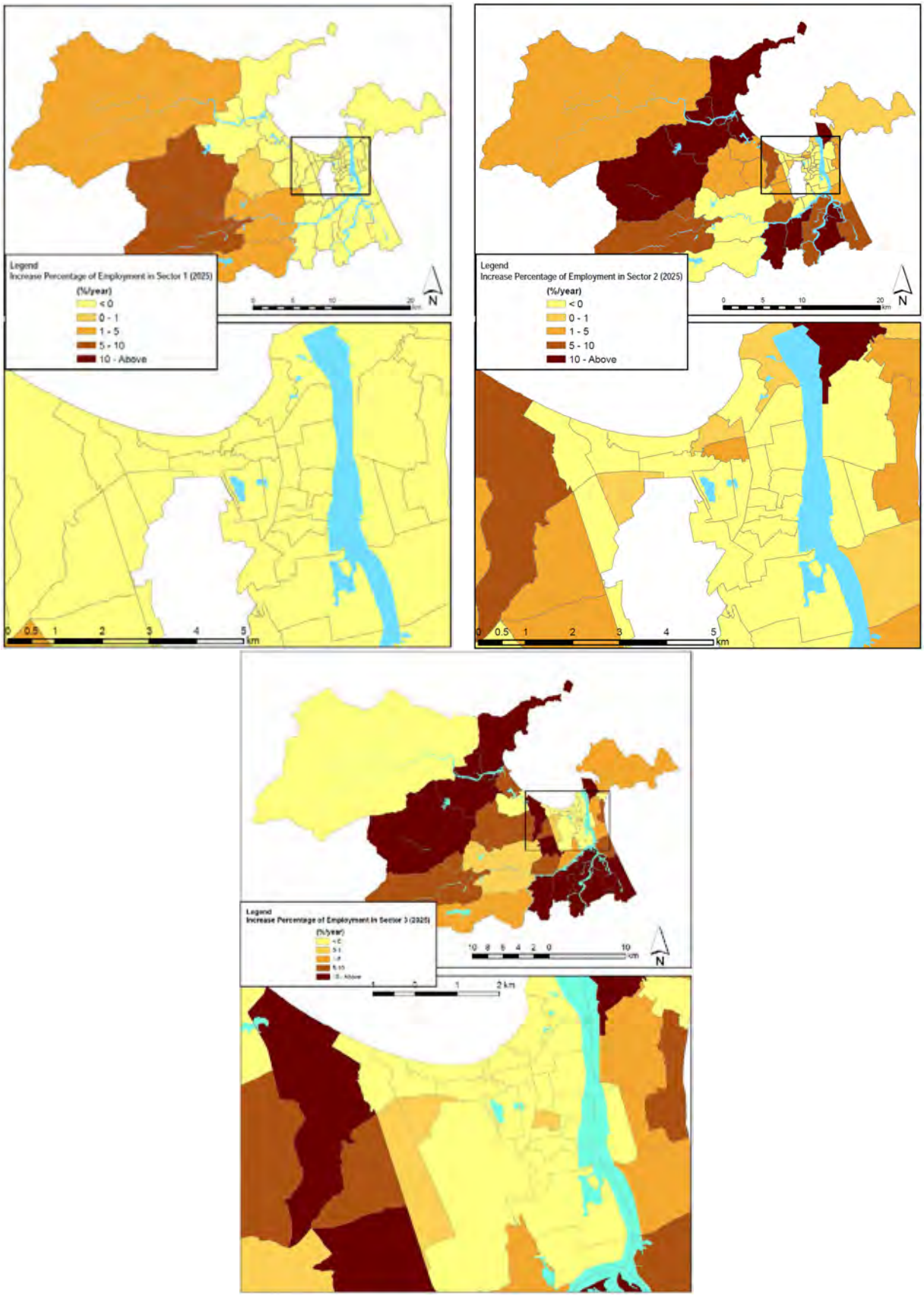
Source: DaCRISS Study Team.

Figure 5.6.3 Distribution of Daytime Workers and Students



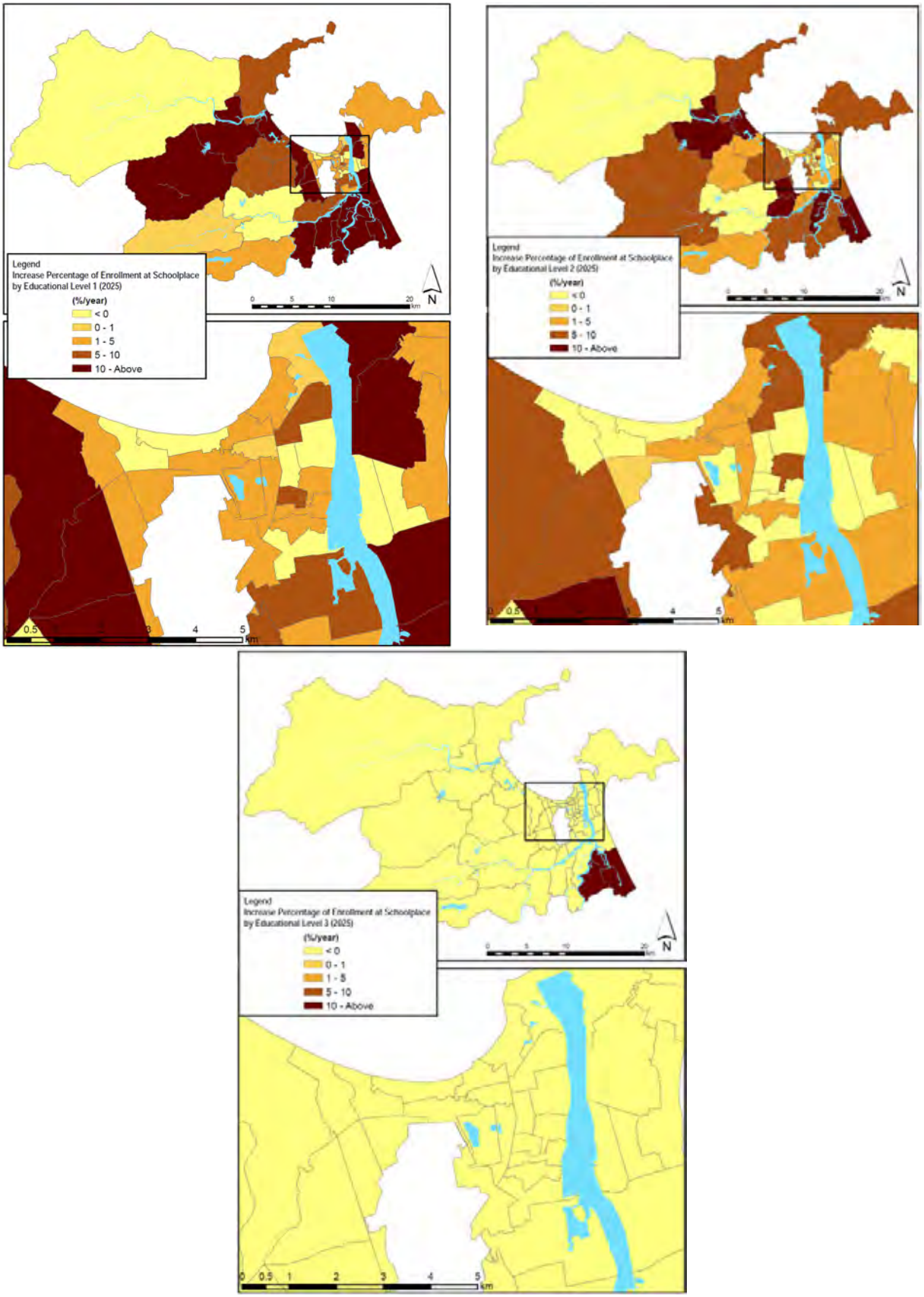
Source: DaCRISS Study Team.

Figure 5.6.4 Increase Ratio of Workers by Sector from 2007 to 2025



Source: DaCRISS Study Team.

Figure 5.6.5 Increase Ratio of Student by Educational Level from 2007 to 2025



Source: DaCRISS Study Team.

5.7 Urban Landscape and Design

1) Context

5.57 Urban landscape and design are new but very important element in urban planning and development for Danang City due to following reasons;

(i) Danang City is a relatively new urban settlement without significant heritages unlike Hoi An and Hue City located in its neighboring areas. However, Danang City has been and is expected to play a role as main gateway to the central region as well as an operating base for integrated development and growth of the region. In order for the city to create an appealing image in the world, not only its function but also its identical image and urban design are important. Danang is tasked with establishing a "image of the city" which express its own identity and at the same time represent collective "image of the region".

(ii) Ample opportunities exist in the city, especially with rich natural environment, ranging from beaches to mountains covered with fauna and flora which spread in marine, land and intricate river system. When these natural environment are combined with the world cultural heritages and urban images of Hoi An and Hue City, Danang City and the region can enhance their collective images significantly.

(iii) As Danang City is expected to grow farther and function as an internationally competitive growth centre in Vietnam following Hanoi and HCMC, its urban, commercial and business function will be expanded in association with inflow of population. It is also an important national agenda to establish a third strong urban core and growth engine in the central part of the country to promote integrated and balanced national land development. Danang City must respond to the national policy commitment. In this context, how to design urban areas and how to manage the process of future development are so important to create identical image and function of the city.

5.58 In short, landscape and urban design provide Danang City with both opportunities and threats depending upon how to deal with the aspects above described.

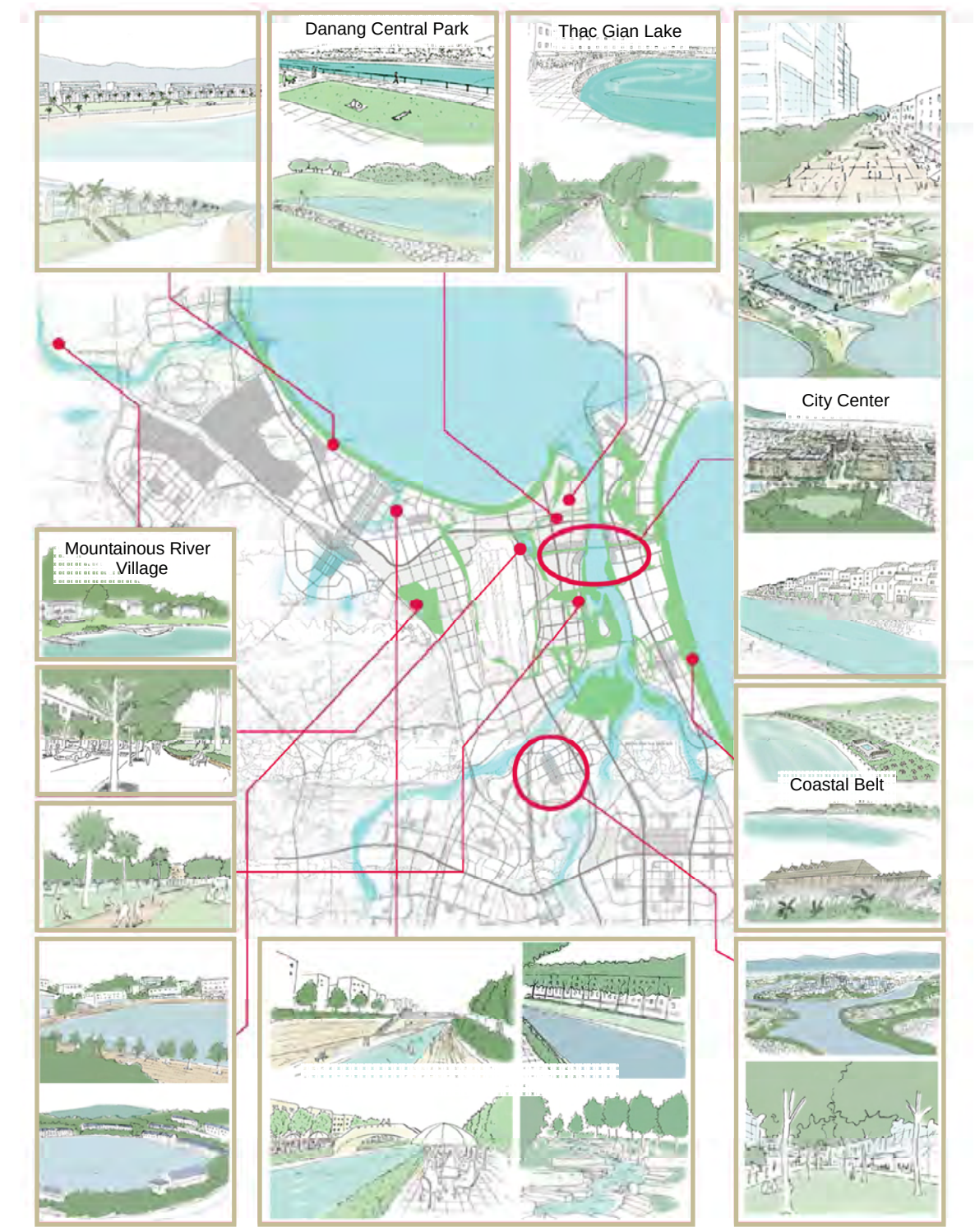
2) Proposals

5.59 Prior to undertaking detailed work on landscape and urban design, it is important to share common understanding on images which must be created in the city. As the first step towards improving urban landscape and design of the city, a study was conducted and following proposals are made;

(a) **Development of Water-green network;** Mountain/forest areas, rivers and riversides, coastal belt, lakes and canals, parks and streets with trees will be connected as an integrated network to create amenity space and landscape. (see Figure 5.7.1)

(b) **Create Identical Landscape for Main Areas;** Danang City must have a clear orientation to create identical and appealing city image by enforcing or guiding future development and redevelopment. Preliminary proposals are made through images worked out for selected important areas by the Study team. (see Figure 5.7.2)

Figure 5.7.1 Water-Green Network



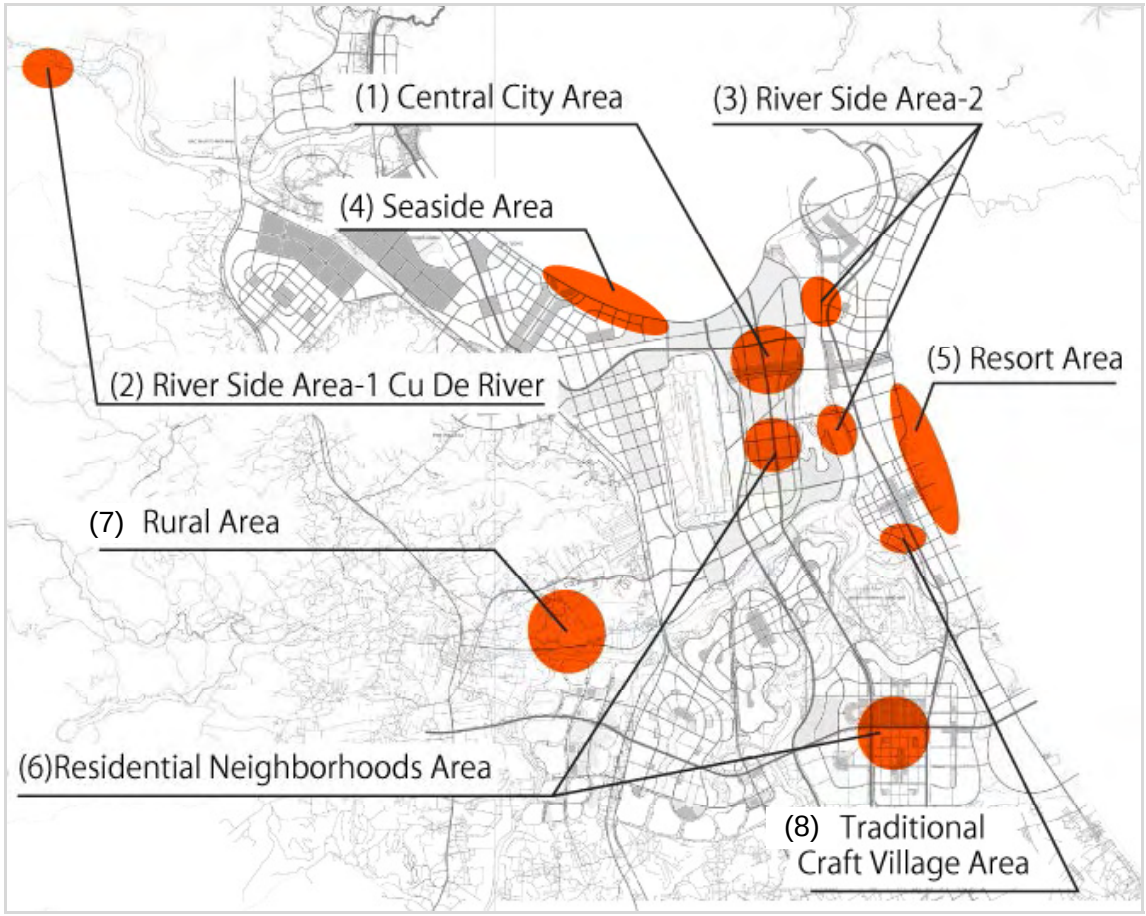
CFEZ Image

City Centre Image

Rural Area Image

Source: DaCRISS Study Team.

Figure 5.7.2 Important Landscape Resources to be Designed in Danang



Source: DaCRISS Study Team.

(1) Image of City Centre

organized building design with cultural flavor and controlled building height

(2) Tourism along Cu De River

Eco-tourism

Riverside Rich in Nature and Living Things

(3) City Centre Area along Han River

coordinated façade design and building height

(4, 5) Resort and Residential Neighborhood along the Coast

(4, 5) Development along the Coast

(6) Image of CBD 3 (South)

modern high-rise buildings in rich green and water

(7) Rural Area

(8) Traditional Craft Village

Source: DaCRISS Study Team.

Figure 5.7.3 Designing of Road Space

- **Car park with planting**

- **Bus stops**

- **Street furniture**

Advertising Pillar

Art Work

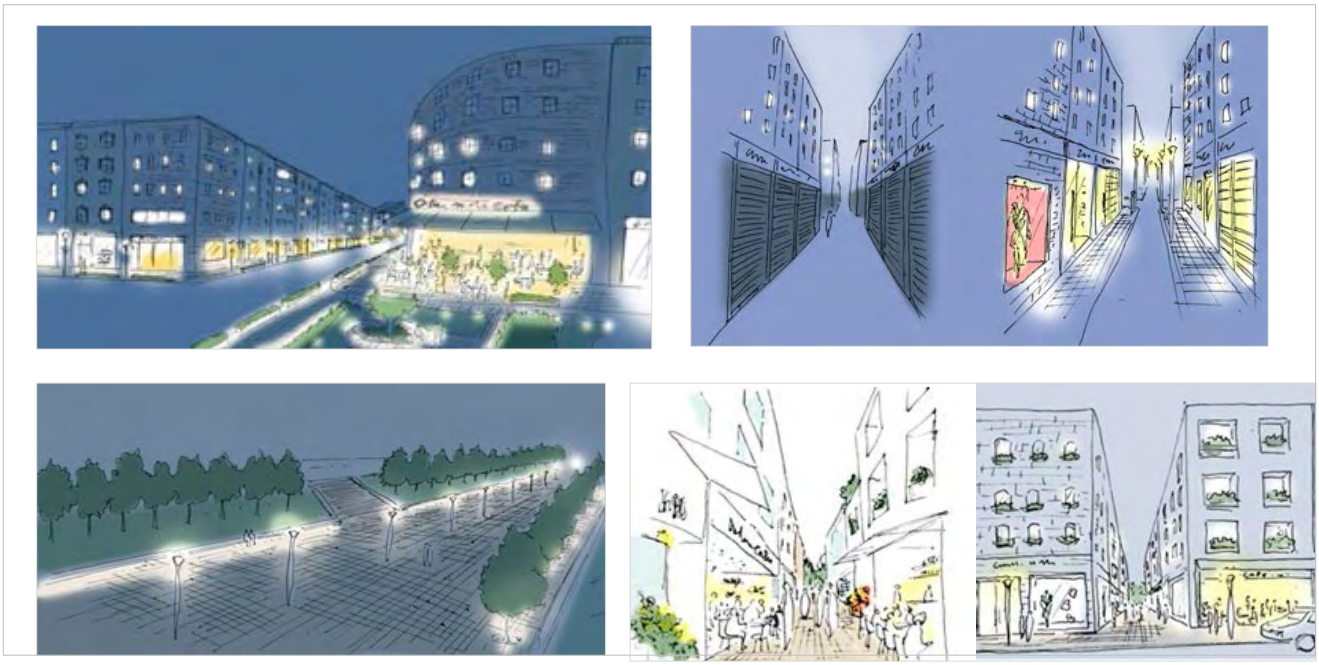
Billboards harmonized with environment

Source: DaCRISS Study Team.

(c) **Designing Street Space:** Streets and their space are important resources for landscape design as well as for enhancement of quality of living. (see Figure 5.7.3)

(d) **Lighting:** Lighting the city is also an important element of enhancing urban landscape and amenity. Different lighting in different areas can emphasize locational characteristics and charm. (see Figure 5.7.4)

Figure 5.7.4 Lighting the City



Source: DaCRISS Study Team.

6 TRANSPORTATION DEVELOPMENT PLAN

6.1 Basic Considerations for Sustainable Transportation Development

1) Strategic Role of Transportation in Urban and Regional Development

6.1 Transportation development is a determinant factor of future growth of Danang City in three ways:

(i) Growth opportunities of Danang City rest on strengthening connectivity with external market such as Hanoi and HCMC metropolitan regions, and main markets in the world, especially those in Asia such as, among others, Bangkok, Singapore, Manila, Shanghai, Hong Kong, Seoul, Tokyo/Osaka, which are main suppliers of investment, information and tourists.

(ii) Integration of CFEZ wherein Danang City functions as a growth engine of the region depends on the connectivity by an adequate transportation network and services.

(iii) Efficient and effective spatial structure and urban development can only be promoted with strategic and integrated transportation development.

6.2 However, development of transportation infrastructure requires a large amount of financial resource and lengthy time, affecting land use, social and environmental conditions. In this respect, transportation planning and development must be implemented in close coordination with those of urban and environmental sectors.

2) Integration of Urban Transportation System with National Transportation Development Strategies

6.3 As Danang City is located in narrow flat lands and the southern foot of Hai Van Pass, major national transportation routes such as National Highway No.1, north-south expressway and north-south high – speed railway concentrate in urban and peri – urban areas. International airport and port are also located in or near the city centre. This situation requires close attention on the following two points:

(i) If proper interface between urban transportation system and these international / national transportation systems are not ensured, the connectivity of the city with the outer areas will be dramatically strengthened.

(ii) If these international / national transportation system is not properly developed, not only expected connectivity with outer areas is ensured but also urban areas will be negatively affected through disintegration of urban areas / land use, occurrence of excessive involuntary resettlements, spoil of urban environment.

6.4 Although the development of these national transportation systems is beyond administrative responsibility of Danang City, it will significantly affect to its urban transportation. In Danang City, the development directions of each national transportation system are currently being studied, planned and implemented as follows:

(a) **North-South Expressway:** As a main part of the nationwide expressway network, the North-South Expressway connecting between Hanoi and HCMC is being studied and planned. According to the report [1] conducted by TEDI for VRA under MOT, Quang Tri (Cam Lo)–Danang (Tuy Loan) section with length of 182km (4 lanes) and Danang–Qunag Ngai section with length of 130km (4–6 lanes) are planned to be constructed

[1] Final Report of the Detailed Plan of North-South Expressway, 2009 March, TEDI

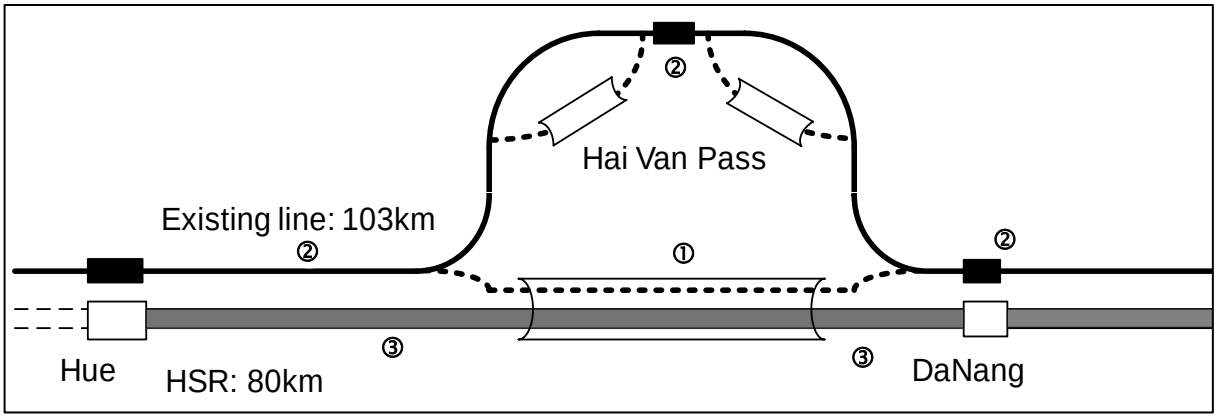
during the period from 2011 to 2020. Therefore in DaCRISS, above-mentioned sections of the North-South Expressway are considered to be completed by 2025.

Figure 6.1.1 Danang–Quang Ngai Expressway Project

Source: DaCRISS Study Team.

(b) **North-South High-Speed Railway (NSHSR):** The project intends to connect Hanoi and HCMC in about 6 hours via Danang city and other main urban areas along the coast-line where future urbanization will be accelerated and main socio-economic activities concentrate. The project when completed will farther promote population increase and urban growth of Danang city which sill be located within a day trip distance to and from Hanoi and HCMC respectively. As this project requires large amount of investment cost (roughly US$3.5 billion excluding rolling stock). An agreement is being held on stage development. Among initial stage of development, Danang–Hue section (80 km) is included together with Hanoi -Thanh Hoa (161 km) and HCMC–Phan Thiet (150 km) as well as Hanoi–Vinh (295 km) and HCMC–Nha Trang (362 km). when the project is completed, the CFEZ will be more firmly integrated each other as well as with NFEZ and SFEZ (see Figure 6.1.2). Pre-feasibility study has been conducted by MOT and the project is subject for approval in the next National Assembly. When the project is completed it will bring about a significant impact not only on Danang but also entire CFEZ. Danang must be prepared for effective integration of the NSHSR with urban transportation network.

Figure 6.1.2 Danang–Hue Section Improvement Project



Source: VITRANSS 2 Study Team.

(c) **Airport:** Danang International Airport is located at just west-south of the city center. In the recommended urban development scenario, this airport will be still retained in the long-term future. Although a capacity of 2 runways is sufficient, the existing passenger terminal building become obsolete and lack of capacity. The on-going project will expand the existing passenger terminal to 36,000 sq.m floor area and capacity of 4 million passengers per annum.

(d) **Ports:** Danang Port is the only one gateway sea port in the City and composed of two terminals: Tien Sa and Song Han. Tien Sa Terminal is located at cove of Son Tra Peninsula and Song Han Terminal in the center of the City along Han River. Capacity of Tien Sa Terminal can accommodate general ship up to 45,000 DWT, 2000 TEU containership and passenger ship up to 75000 GRT and its cargo handling capacity is 4.5

million MT/year together with its freight yards and warehouse nearby and that of Song Han Terminal is 1 million MT/year. In addition, Lien Chiu Port is being constructed mainly serving for Hai Van Cement Plant and Line Chieu Industrial Zone and others.

3) Urban Transportation Development Integrated with Urban Growth Management Strategy

6.5 Taking into account of the factors analyzed and discussions held in previous chapters, basic spatial structure for the city has been prepared with following outlined features: (refer to Figure 6.1.1)

(a) Environmental factors basically allow development of urban areas in north-south directions sandwiched between the coast and upland, though river system must be duly considered in the southern areas.

(b) Coastal zone, upland zone and water front along the rivers and lakes provide an important space not only from natural environment preservations but also from enhancing landscape and urban amenity, as well as providing recreational space for the people and visitors and establishing an identical image of the city.

(c) Transportation network will be composed of in a linear ladder form comparing (i) National/regional transportation corridor, (ii) Main urban axis and (iii) Coastal corridor which are connected each other by lateral primary and secondary urban roads. Main function of the vertical transportation corridors is as follows:

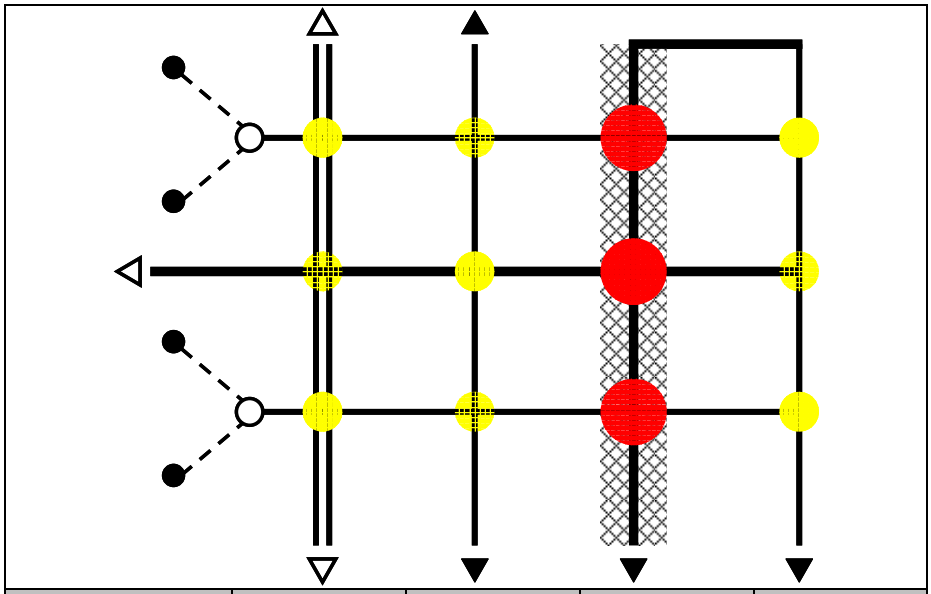
(i) **National/Regional Transportation Corridor:** The corridor comprise all regional transportation network such as NRI, Vietnam Railway, Expressway, High-speed Railway and provide transportation access to the adjoining provinces and the rest of the country. Locating the corridor on the western edge of urban areas, mixture of regional and inter-provincial traffic can be effectively separated from urban traffic.

(ii) **Main Urban Axis**: This forms the backbone of the urban area connecting main urban centres and providing access to all other main parts of the city. This axis will be provided with capable public transportation system to ensure main flow of urban traffic for all groups of the people. This axis will also be extended to integrate future urban areas of Quang Nam Province.

(iii) **Coastal Axis:** This will be an unique and precious transportation corridor to cover prime coastal areas of the city as well as Quang Nam Province. This axis must be designed in a way that it will not only provide transportation services but also integrated amenity space.

(d) Integrated land use and urban development with transportation and environmental management is the key to realize sustainable urban form. This concept is farther illustrated in Figure 6.1.3.

Figure 6.1.3 Structure of Transportation Network, Land Use and Environmental Control



Function	National / Regional	Inter–Urban	Main Urban	Coastal
Access Control	Fully Controlled	Semi Controlled	Integrated	Integrated
Main Land Use	Industry /Logistics	Light Industry / Mixed	Commercial /Business/Mixed	Tourism /Recreational / Mixed
Density	Low	Medium	High	Low / Medium
Environmental Control	Strong	Moderate	Moderate	Strong

Source: DaCRISS Study Team

4) Modal Share Policy

(a) **Alternative Modal Share Scenarios:** Before gaps between future supply and demand are assessed, future composition of urban transportation shall be further discussed. As shown in Table 6.1.1, it is clear that a bus is the most efficient mode of road-based transportation. Cars require 4–9 times bigger road space compare to bus for transporting same number of passengers. This means that the traffic impacts could be alleviated by shifting use of transportation mode from cars and motorcycles to buses.

Table 6.1.1 Utilization Efficiency of Road Space by Transportation Mode

	Car	Motorcycle	Bus [1)]
Average Occupancy (pax/vehicle)	2.0	1.3	15–36
PCU (Passenger Car Unit)	1.0	0.4	2.0
Ave. No. of Passengers per PCU	2.0	3.0	8–18

Source: DaCRISS Study Team

[1)] Average occupancy of bus is 15 passengers at present. It is assumed that it will increase if urban bus service is significantly improved.

6.6 For the numerical simulation analysis, different modal share scenarios are assumed as shown in Table 6.1.2 and described as follows:

(a) **Base Scenario:** This is supposed to be at least a target modal share for Danang City. This requires sufficient improvements of bus services and proper traffic management.

(b) **Alternative 1:** This represents the present modal share in the future. This needs strong effort to regulate the use of cars which number is rapidly increased recently.

(c) **Alternative 2:** This represents the estimated modal share if there is no effort to regulate cars and to improve bus services. Modal share of motorcycle will still remain at 70% and share of cars will also increase by 20%.

(d) **Alternative 3:** This is the most preferable case. Modal share of buses will increase by 50%. However it requires strong effort to improve bus services and to promote bus usage.

(e) **Alternative 4:** This represents the worst case. Modal share of cars will increase by 30% and share of motorcycle will still remain at 60%.

Table 6.1.2 Different Modal Share Scenarios

Modal Share Scenario		Modal Share (%)			Average Occupancy (pax)		
		Motor-cycle	Car	Bus	Motor-cycle	Car	Bus
Base	Target	50	15	35	1.3	2.0	36
Alternative Scenario	1. Present	94	2	4	1.3	2.0	15
	2. Trend	70	20	10	1.3	2.0	15
	3. Strong Bus Improvement	35	15	50	1.3	2.0	50
	4. Increased of Car Use	60	30	10	1.3	2.0	15

Source: DaCRISS Study Team

(b) **Preparation of "Do-nothing" and "Do-committed" Network:** The existing urban transportation network (as of September 2008) is employed as the Do-nothing network. On the other hand, the Do-committed network is prepared by adding the major on-going and committed projects in addition to the existing network. In this case, not all transportation projects are included. Only projects which will serve significantly for inter-zonal traffic and will be surely implemented are selected.

6.7 As mentioned in the previous section, the North-South Expressway is included in the Do-committed network. On the other hand, North-South High-speed Railway is not included. As for other inter-city transportation system such as airport and port, current government plans are assumed to be implemented by the year 2025.

(c) **Assessment by "Do-nothing" and "Do-committed" Analysis:** Overall traffic situation in Danang City will be chaotic if no transportation infrastructure is added to the existing transportation network (Do-nothing case) or if only on-going and committed projects are added (Do-committed case). Future traffic demands by modal share scenario are assigned on the Do-nothing and Do-committed network. As a result of analysis on Do-nothing and Do-committed cases, network performance indicators are summarized in Table 6.1.3 and Table 6.1.4, respectively.

6.8 In the Do-nothing case, traffic situation will get worse of course. A total traffic demand (PCU) increases 2.3–4.1 times of the existing. Traffic load (PCU-km) also increases 3.5–4.9 times due to extended average travel distance in the future. Average V/C ratio is worsened from 0.18 to 0.52–0.69. Average travel speed becomes slow from 44 kph to 27–35 kph. Transportation cost also increases 8–12 times.

6.9 On the other hand, in the Do-committed case, traffic situation will be slightly improved in all of indicators, decreasing about 9% in terms of transportation cost. In both of two cases, it is clear that Alternative 4 (Increase of Car Use) is the worst, and Alternative 3 (Strong Bus Improvement) and Base Case (Target Modal share) are the most efficient

among all scenarios. Assigned traffic and V/C ratio by road links are compared by modal share scenario in Figure 6.1.4.

Table 6.1.3 Traffic Situations by Modal Share Scenario (Do-nothing Case)

Performance Indicator		2008 94/2/4[1)]	Do-nothing (2025)				
			Base 50/15/35[1)]	Alt.1 94/2/4[1)]	Alt.2 70/20/10[1)]	Alt.3 35/15/50[1)]	Alt.4 60/30/10[1)]
Traffic Demand (mil. PCU)		424	1,192	1,303	1,562	995	1,719
Traffic Load	PCU-km (mil.)	2,594	9,883	10,935	12,462	9,132	12,665
	PCU-hrs. (mil.)	59	302	363	459	265	474
Travel Features	Ave. Travel Speed (kph)	44	33	30	27	35	27
	Ave. V/C Ratio	0.18	0.56	0.61	0.68	0.52	0.69
Transportation Cost (mil. US$)	Vehicle Operation Cost	285	1,496	1,189	2,085	1,387	2,187
	Travel Time Cost	360	3,961	3,961	5,132	3,684	5,309
	Total Cost	644	5,457	5,150	7,218	5,070	7,496

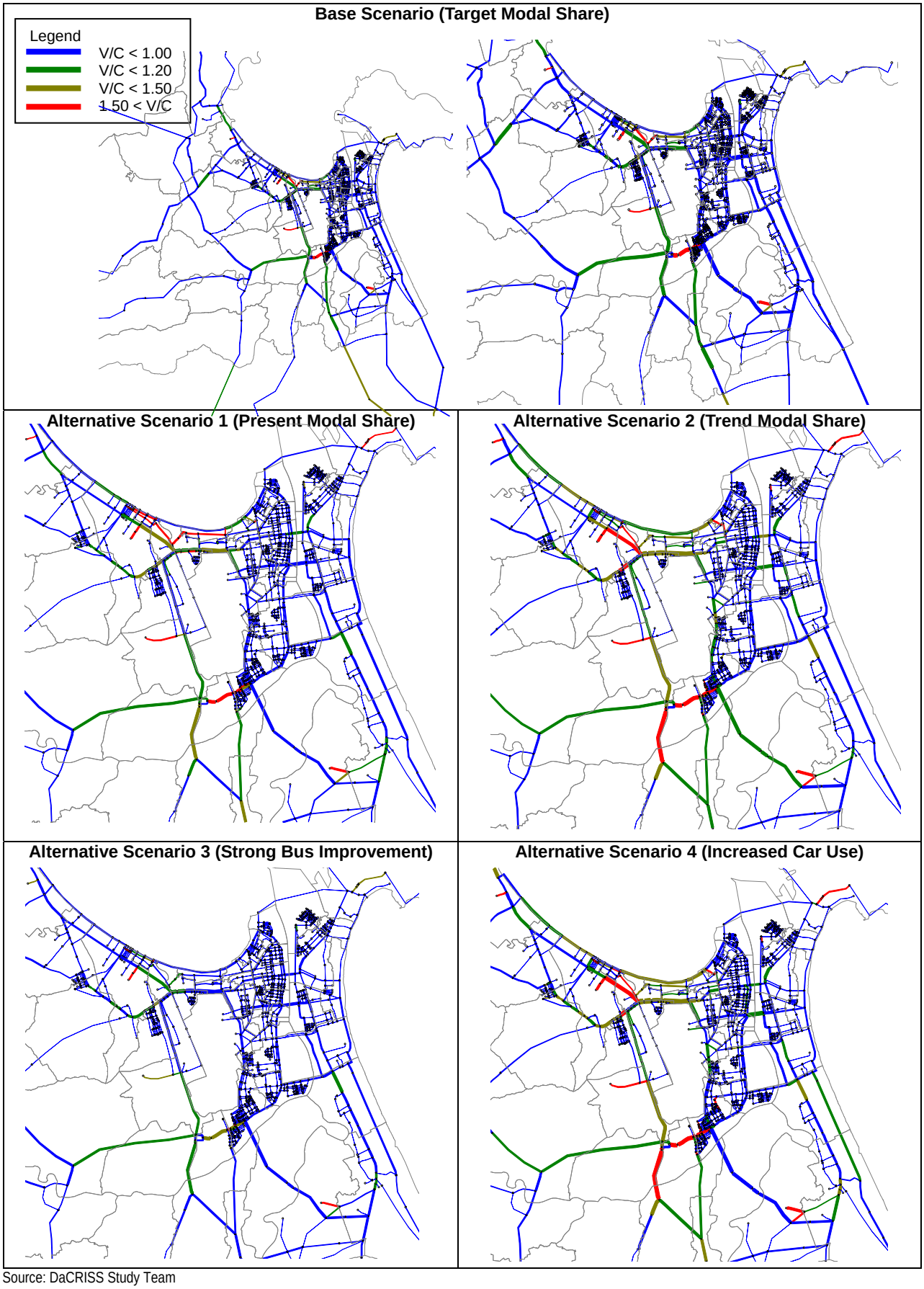
Source: DaCRISS Study Team
[1)] Share (%) of Motorcycle/Car/Bus

Table 6.1.4 Traffic Situations by Modal Share Scenario (Do-Committed Case)

Performance Indicator		2008 94/2/4[1)]	Do-committed (2025) [1)]				
			Base 50/15/35[1)]	Alt.1 94/2/4[1)]	Alt.2 70/20/10[1)]	Alt.3 35/15/50[1)]	Alt.4 60/30/10[1)]
Traffic Demand (mil. PCU)		424	1,192	1,303	1,562	995	1,719
Traffic Load	PCU-km (mil.)	2,594	9,600	10,594	12,016	8,825	12,278
	PCU-hrs. (mil.)	59	279	337	416	239	432
Travel Features	Ave. Travel Speed (kph)	44	34	31	29	37	28
	Ave. V/C Ratio	0.18	0.56	0.61	0.68	0.52	0.70
Transportation Cost (mil. US$)	Vehicle Operation Cost	285	1,426	1,139	1,959	1,302	2,066
	Travel Time Cost	360	3,571	3,610	4,605	3,271	4,787
	Total Cost	644	4,997	4,748	6,564	4,573	6,852

Source: DaCRISS Study Team
[1)] Share (%) of Motorcycle/Car/Bus

Figure 6.1.4 Assignment of Future Demand by Modal Share Scenario (Do-Committed Case)



Source: DaCRISS Study Team
Note: V/C Ratio denotes daily average.

6.10 In order to evaluate the traffic impacts from alternative modal share scenarios in detail, network was classified by corridor and area as shown in Figure 6.1.5. In the meantime, a total of 6 corridors linking with the CBD areas of Hai Chau and Thanh Khe are identified with 15 classified areas.

6.11 As a result of the Do-committed case, Table 6.1.5 and Table 6.1.6 summarize a traffic congestion level by classified area and by corridor sections, respectively. Here, congestion level is represented by V/C ratio (an average ration of 12 hour traffic from 7 am to 7 pm).

6.12 V/C ratio exceeds 1.0 in many classified areas excluding in Son Tra, Lien Chieu and Hoa Vang. The congestion is relatively serious in the areas of NH1 South and Ngu Hanh Son where new CBD or intensive urban development is proposed and their existing road network is very poor. From the viewpoints of congestion by corridor section, in addition to the sections in NH1 South and Ngu Hanh Son corridors and radial roads in Hoa Vang are also congested seriously.

(d) **Recommended Modal Share Policy (Target Modal Share):** The analysis of Do-nothing and Do-committed cases brought some key suggestions for planning a future urban transportation system. They are:

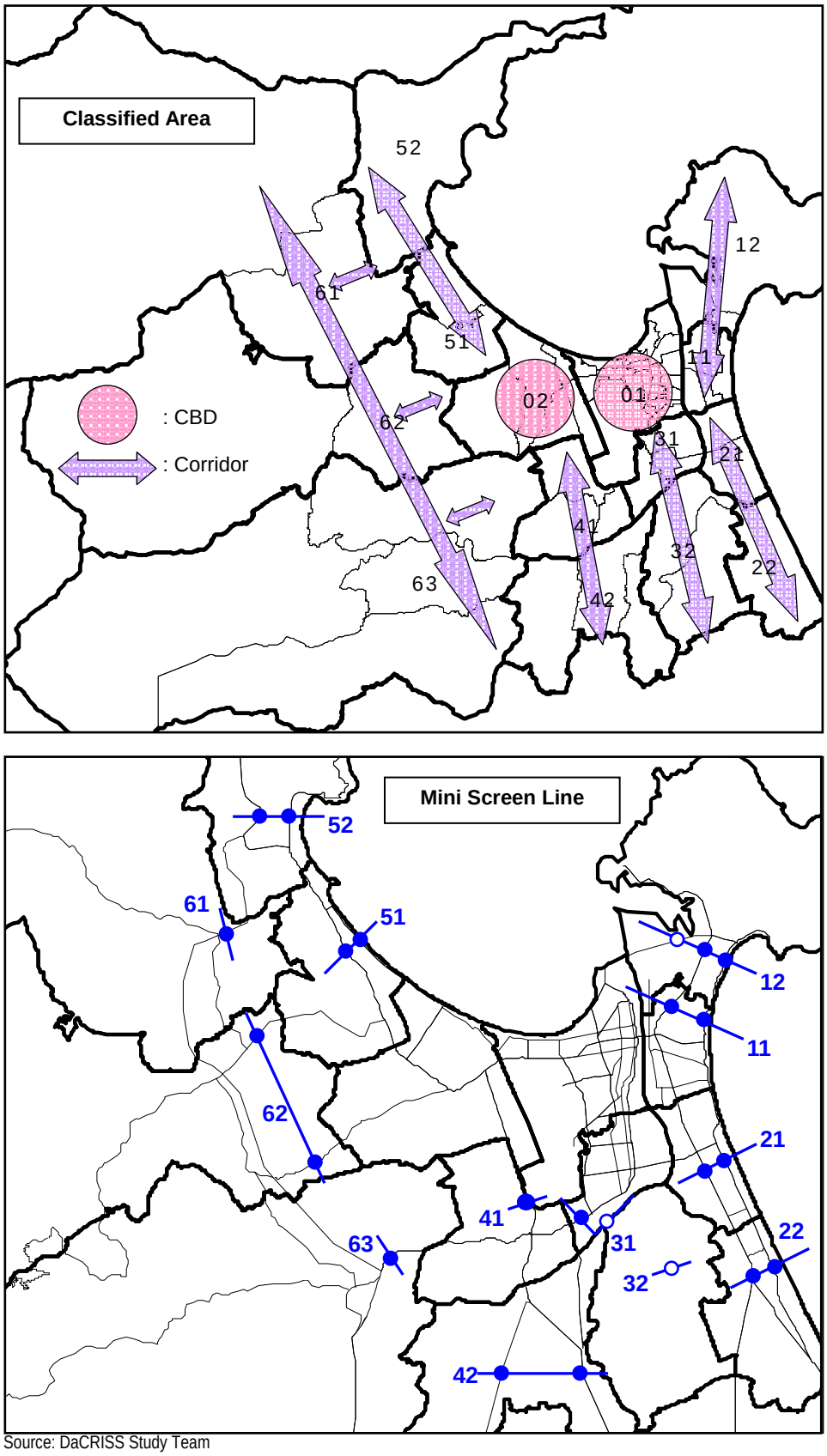
(i) Modal share policy is very effective to improve the network performance if a good bus service is assured. Basic orientation such as improvement of bus services and promotion of its utilization should be first considered as a basis of formulating future urban transportation network.

(ii) In order to meet a huge future traffic demand, only modal share policy is not enough. In addition to the existing urban transportation network, comprehensive measures including road development, public transportation development and traffic management are to be implemented.

6.13 At this stage of network planning, modal share policy shall be determined as an initial target of future modal share. This would be a basis of future urban transportation system. Although the most efficient scenario (less traffic load on the network and less transportation cost, high travel speed, low V/C ratio) is to be selected as target, each scenario has conditions for its realization.

6.14 Therefore, In DaCRISS, the Base Modal Share Scenario (modal share: motorcycle 50%, car 15%, bus 35%, vehicle occupancy: motorcycle 1.3, car 2.0, bus 36) is employed as a basis of planning for urban transportation network in Danang. In the Do-committed analysis for Base Modal Share Scenario, V/C ratio will be still under 1.0 in the existing CBDs in Hai Chau and Thanh Khe where new road construction and widening is very difficult.

Figure 6.1.5 Zoning and Mini Screen Lines for Network Analysis and Planning



Source: DaCRISS Study Team

Table 6.1.5 Traffic Conditions by Modal Share Scenario (Do-committed, by area)

Corridor/Area		V/C Ratio[1] on Do-committed Network[2]					
		Existing (2008)	Modal Share Scenario (2025)				
		94/2/4	Base 50/15/35	Alt.1 94/2/4	Alt.2 70/20/10	Alt.3 35/15/50	Alt.4 60/30/10
CBD	01 Hai Chau	0.5	0.8	0.9	1.0	0.7	1.1
	02 Thanh Khe	0.6	1.0	1.1	1.3	0.8	1.3
1. Son Tra	11 Inner	0.3	0.5	0.7	0.7	0.5	0.7
	12 Outer	0.3	0.2	0.2	0.2	0.2	0.3
2. NHS Coastal	21 Inner	0.3	0.9	1.1	1.1	0.9	1.2
	22 Outer	0.3	0.8	1.0	1.0	0.8	1.1
3. NHS Central	31 Inner	0.5	0.6	0.6	0.8	0.5	0.8
	32 Outer	0.2	0.6	0.6	0.6	0.5	0.6
4. NH1 South	41 Inner	0.5	1.6	1.7	1.9	1.5	1.9
	42 Outer	0.5	0.9	1.0	1.1	0.8	1.1
5. Lien Chieu	51 Inner	0.3	0.8	0.9	1.1	0.8	1.1
	52 Outer	0.2	0.5	0.7	0.7	0.5	0.7
6. Rural	61 HV North	0.0	0.6	0.7	0.7	0.5	0.7
	62 HV Central	0.1	0.6	0.6	0.8	0.6	0.8
	63 HV South	0.1	0.7	0.6	0.6	0.7	0.6
City Total		0.3	0.7	0.8	0.9	0.7	0.9

Source: DaCRISS Study Team
Note:
[1] V/C is calculated as an average of 12 hour (7am–7pm). For this, daytime/nighttime ratio (75%) of traffic production was assumed. Roads with no traffic volume is assigned are not included in this calculation.
[2] Expressway is not included

Table 6.1.6 Traffic Conditions by Modal Share Scenario (Do-committed, by section)

Corridor/Area			V/C Ratio[1] on Do-committed Network[2]					
			Existing (2008)	Modal Share Scenario (2025)				
			94/2/4	Base 50/15/35	Alt.1 94/2/4	Alt.2 70/20/10	Alt.3 35/15/50	Alt.4 60/30/10
1. Son Tra	11 Inner (S)	Ngo Quyen	0.5	0.6	0.6	0.7	0.5	0.7
		SonTra-DienNgoc	0.0	0.3	0.3	0.4	0.2	0.4
	12 Outer (N)	Ngo Quyen	0.3	0.4	0.4	0.5	0.3	0.6
		SonTra-DienNgoc	0.0	0.2	0.2	0.3	0.2	0.3
		Thuan Phuoc Br.	-	0.3	0.4	0.5	0.3	0.6
2. NHS Coastal	21 Inner (N)	Le Van Hien	0.4	1.4	1.8	1.8	1.6	1.9
		Yersin	0.3	1.2	1.3	1.3	0.9	1.5
	22 Outer (S)	Le Van Hien	0.3	1.1	1.4	1.3	1.3	1.4
		Yersin	0.3	1.2	1.3	1.3	0.9	1.5
3. NHS Central	31 Inner (N)	CMTT (NH14B)	0.6	1.1	1.3	1.4	1.1	1.3
		N. Huu Tho(PIIP)	-	1.3	1.2	1.5	1.0	1.4
	32 Outer (S)	N. Huu Tho(PIIP)	-	1.3	1.2	1.5	1.0	1.4
4. NH1 South	41 Inner (N)	Truong Chinh (NH1)	0.5	1.6	1.7	2.1	1.5	2.1
	42 Outer (S)	NH1A	0.4	1.4	1.5	1.6	1.3	1.7
		PR605	0.2	1.4	1.6	1.9	1.2	1.9
5. Lien Chieu	51 Inner (E)	N. Tat Thanh	0.0	0.6	1.0	1.1	0.5	1.1
		N.LuongBang(NH1)	0.5	0.9	1.0	1.1	0.9	1.1
	52 Outer (W)	N. Van Cu	0.0	0.0	0.1	0.1	0.0	0.1
		NH1 (Haivan Tunnel)	0.4	0.8	1.0	1.0	0.8	1.0
6. Rural	61 HV North	NH1A Bypass	0.0	0.6	0.7	0.9	0.7	0.9
	62 HV Central	PR602	0.1	1.7	1.6	1.9	1.6	2.0
		Hoang Van Thai	0.0	0.5	0.6	0.9	0.3	1.0
	63 HV South	NH14B	0.4	1.6	1.6	1.8	1.5	1.8

Source: DaCRISS Study Team
Note:
[1] V/C is calculated as an average of 12 hour (7am–7pm). For this, daytime/nighttime ratio (75%) of traffic production was assumed.
[2] Expressway is not included

5) Future Transportation Demand-Supply Gaps by Corridor and by Area

6.15 As discussed in the previous section, in planning and assessment of network, important assumptions were made on future modal share and vehicle occupancy for each mode of transportation. These assumptions are supposed to be achieved by appropriate improvement of bus services as well as conventional traffic management measures. Assumptions are as follows:

(i) Modal Share: Motorcycle 50%, Car 15%, Bus 35%

(ii) Vehicle Occupancy: Motorcycle 1.3, Car 2.0, Bus 36

6.16 Based on the Do-nothing and Do-committed analysis, demand and supply gaps (V/C for 12 hours from 7 am to 7 pm) are summarized by corridor as shown in Table 6.1.7 and Table 6.1.8.

Table 6.1.7 Assessment of Traffic Conditions by Area

Corridor/Area		Existing (2008) [1]			Do-nothing (2025) [1),2)]		Do-committed (2025) [1),2),3)]		
		Capacity (000 PCU-km)	Traffic Vol. (000 PCU-km)	V/C Ratio	Traffic Vol. (000 PCU-km)	V/C Ratio	Capacity (000 PCU-km)	Traffic Vol. (000 PCU-km)	V/C Ratio
CBD	01 Hai Chau	1,040	503	0.5	987	0.7	1,247	968	0.8
	02 Thanh Khe	375	223	0.6	649	1.0	498	474	1.0
1. Son Tra	11 Inner	361	122	0.3	268	0.4	467	249	0.5
	12 Outer	190	47	0.3	66	0.1	361	68	0.2
2. NHS Coastal	21 Inner	378	112	0.3	505	1.0	416	364	0.9
	22 Outer	308	83	0.3	416	1.0	323	272	0.8
3. NHS Central	31 Inner	338	156	0.5	562	0.7	630	375	0.6
	32 Outer	26	5	0.2	90	1.2	70	44	0.6
4. NH1 South	41 Inner	341	158	0.5	641	1.4	332	530	1.6
	42 Outer	311	155	0.5	614	1.1	412	371	0.9
5. Lien Chieu	51 Inner	434	128	0.3	484	0.8	381	312	0.8
	52 Outer	692	113	0.2	387	0.5	691	348	0.5
6. Rural	61 HV North	779	14	0.0	499	0.5	926	511	0.6
	62 HV Central	657	46	0.1	609	0.6	1,108	666	0.6
	63 HV South	841	80	0.1	599	0.7	814	544	0.7
City Total		7,004	1,946	0.3	7,377	0.7	8,677	6,092	0.7

Source: DaCRISS Study Team
Note:
[1)] V/C is calculated as an average of 12 hour (7am–7pm). For this, daytime/nighttime ratio (75%) of traffic production was assumed. Roads with no traffic volume is assigned are not included in this calculation.
[2)] Assumed modal share (%) of M/C, car and bus: 50/15/35, Average occupancy: M/C 1.3, car 2.0 and bus 36
[3)] Expressway is not included

Table 6.1.8 Assessment of Traffic Conditions by Corridor

Screen Line/Section			No. of Lanes	Capacity (000 PCU)[1]	Existing (2008)[1]		Do-nothing (2025)[1],[2]		Do- committed (2025)[1],[2],[3]	
					Traffic Vol. (000 PCU)	V/C Ratio	Traffic Vol. (000 PCU)	V/C Ratio	Traffic Vol. (000 PCU)	V/C Ratio
1. Son Tra	11 Inner (S)	Ngo Quyen	4	28.2	12.8	0.5	24.2	0.9	16.7	0.6
		SonTra–DienNgoc	4	28.2	1.3	0.0	4.1	0.1	7.5	0.3
	12 Outer (N)	Ngo Quyen	4	28.2	9.5	0.3	14.4	0.5	11.9	0.4
		SonTra–DienNgoc	4	28.2	1.3	0.0	4.0	0.1	5.5	0.2
		Thuan Phuoc Br.	4	28.2	-	-	-	-	9.8	0.3
2. NHS Coastal	21 Inner (N)	Le Van Hien	4	28.2	12.2	0.4	61.7	2.2	39.6	1.4
		Yersin	4	28.2	7.6	0.3	37.8	1.3	32.4	1.2
	22 Outer (S)	Le Van Hien	4	28.2	9.1	0.3	40.8	1.4	29.7	1.1
		Yersin	4	28.2	7.6	0.3	37.8	1.3	32.3	1.2
3. NHS Central	31 Inner (N)	CMTT (NH14B)	4	28.2	18.1	0.6	53.2	1.9	32.1	1.1
		N. Huu Tho(PIIP)	6	42.5	-	-	-	-	54.5	1.3
	32 Outer (S)	N. Huu Tho(PIIP)	6	42.5	-	-	-	-	54.5	1.3
4. NH1 South	41 Inner (N)	Truong Chinh (NH1)	4	28.2	14.1	0.5	57.1	2.0	45.2	1.6
	42 Outer (S)	NH1A	4	28.2	12.6	0.4	54.3	1.9	39.7	1.4
		PR605	4	30.7	5.6	0.2	48.0	1.6	41.7	1.4
5. Lien Chieu	51 Inner (E)	N. Tat Thanh	4	28.2	0.3	0.0	20.5	0.7	17.1	0.6
		N.LuongBang(NH1)	4	28.2	14.3	0.5	34.8	1.2	25.0	0.9
	52 Outer (W)	N. Van Cu	4	27.8	0.0	0.0	0.9	0.0	0.9	0.0
		NH1 (Haivan Tunnel)	4	28.2	10.2	0.4	23.9	0.8	23.9	0.8
6. Rural	61 HV North	NH1A Bypass	4	21.6	0.2	0.0	14.4	0.7	12.9	0.6
	62 HV Central	PR602	4	27.8	0.3	0.1	33.8	1.2	47.7	1.7
		Hoang Van Thai	2	19.6	0.0	0.0	4.4	0.5	4.7	0.5
	63 HV South	NH14B	4	28.2	10.0	0.4	53.8	1.9	44.2	1.6

Source: DaCRISS Study Team
Note:
[1] V/C is calculated as an average of 12 hour (7 am–7 pm). For this, daytime/nighttime ratio (75%) of traffic production was assumed.
[2] Assumed modal share (%) of M/C, car and bus: 50/15/35, Average occupancy: M/C 1.3, car 2.0 and bus 36
[3] Expressway is not included

6.2 Basic Structure of Urban Transportation Network

1) Development Opportunities of Future Transportation Network

6.17 Network deficiencies were assessed by corridor. In order to meet future transport demands based on the Base Modal Share Scenario, required network capacities are identified by corridor. The possibility of improvement/construction of existing at-grade road was first examined. This was followed by the introduction of other measures like traffic management, further road improvement and development of an UMRT system. The results of these examinations are summarized in Table 6.2.1.

6.18 As is also indicated in Urban General Plan, future expansion of urban areas is partly towards Lien Chieu and largely towards the south wherein new CBDs are expected to emerge. Therefore the main backbone of the city is along the corridor linking the north-northwest and the south via existing city centre areas. When this strong transportation backbone is provided in integration with strategic urban development, investments to the north-northwest and the south area are expected to increase and reduce excessive concentration in the existing urban centre.

6.19 Hai Chau and Thanh Khe are mostly occupied by built-up area. In these areas, road development such as new construction and widening is essentially very difficult. Therefore, the traffic efficiency shall be increased by modal share policy as much as possible. In case of the Base Modal Share Scenario, V/C ratio in these areas will be more or less 1.0 without any additional road development. In other areas, V/C ratio will be reduced by new road construction and/or road widening and so on.

Table 6.2.1 Transportation Corridor Development Opportunities

Corridor/Area		Existing Road		Required No. of Lanes [1), 2)]	Possibility of Road Development [3)]		Alternative Solutions [4)]					
							Traffic Management		Road Development			UMRT
		No. of Roads	Total No. Lanes		Widening	New Road	Traffic Mgmt.	TDM	Widening	New Road (at-grade)	New Road (elevated)	
CBD	01 Hai Chau	-	-	-	C	C	A	A	B	B	A	A
	02 Thanh Khe	-	-	-	C	C	A	A	B	B	A	A
1. Son Tra	11 Inner	2	8	4	B	B	A	B	A	B	B	A
	12 Outer	2	8	4	B	B	B	C	B	A	C	B
2. NHS Coastal	21 Inner	2	8	11	B	B	A	B	A	B	B	A
	22 Outer	2	8	9	B	A	B	B	B	A	C	A
3. NHS Central	31 Inner	1	4	13	B	A	A	B	A	B	B	A
	32 Outer	0	0	8	B	A	B	B	B	A	C	A
4. NH1 South	41 Inner	1	4	7	B	B	A	C	A	A	C	B
	42 Outer	2	8	12	B	A	B	C	B	A	C	C
5. Lien Chieu	51 Inner	2	8	7	B	B	A	B	A	B	B	B
	52 Outer	2	8	4	B	B	B	C	B	B	C	C
6. Rural	61 HV North	1	4	2	B	B	B	C	B	B	C	C
	62 HV Central	2	6	8	B	A	B	C	B	A	C	C
	63 HV South	1	4	7	B	A	B	C	B	A	C	C

Source: DaCRISS Study Team

[1)] Estimated based on the Do-committed situation, assuming a standard capacity of 7,000 PCU/lane/12-hours

[2)] Assumed modal share (%) of motorcycle, car and bus: 50/15/35, Average occupancy: motorcycle 1.3, car 2.0 and bus 36

[3)] Possibility of road development: A-possible, B-possible with some difficulty, C-difficult

[4)] Assessment of alternative solutions: A-recommended, B-for consideration, C-not recommended

2) Proposed Structure of Urban Transportation Network

6.20 The basic structure of urban transportation network for Danang City was preliminary formulated based on the analysis in the previous sections. Urban transportation infrastructures are basically planned within the development area set under the future land use plan.

6.21 The principles in developing urban transportation network is to cater the transportation infrastructure and services for various needs and functions to be satisfied, and those are described as follows:

(a) **Inter-city Passenger Transportation Network:** The existing Danang Railway Station and the provincial bus terminal will be relocated in the vicinity of the New Danang Station of North-South High-Speed Railway (NS-HSR) in the south of Lien Chieu District where will emerge one of the future sub-urban centers of Danang City. This will provide easy transfer for passengers. Danang International Airport will remain at the present location and should be upgraded of its terminal capacity. Terminal facilities for passenger ships will be developed at the west bank of Han River. In order to provide good access to those passenger terminals, convenient public transportation services including urban bus system and UMRT should be provided.

(b) **Inter-city Freight Transportation Network:** Ports will play an important role in inter-city transportation of goods to and from Danang City. A large volume of cargoes will be transported between two ports (Tien Sa and Lien Chieu) and industrial zones in Danang City and neighboring provinces in the Central Vietnam. In order to accommodate a large volume of truck traffic, primary road network is carefully studied. In this case, the following conditions should be taken into consideration:

  (i) To efficiently link several hubs of freight transportation such as ports and industrial zones with inter-city road network such as North-South Expressway and National Highway 1A Bypass.

  (ii) To avoid large volume of truck traffic to enter urban centers, newly developed areas in the south and the east coast resort area.

(c) **Road Network:** This is a combination of primary and secondary roads. A primary road network serves mainly for inter-district traffic with relatively longer travel distance. Scale and characteristics of urban development are taken into consideration of network planning. On the other hand, a secondary road network will supplement primary road network and serve for intra-district traffic with relatively short travel distance. Density of urban development is taken into consideration of network planning.

(d) **Mass Transit Corridors:** In order to provide an efficient transportation service between major area and points where large volume of traffic demand is generated and attracted, i.e. existing and new urban centers, district centers, railway stations, airport, new development areas designated in the urban development scenario and to avoid excessive investment on road development, UMRT network serving for major mass transit corridors is preliminarily examined.

(e) **Other Transportation Systems:** Above-mentioned major transportation networks are supported by the plans for efficient and effective traffic management, walking and non-motorized transportation and other new transportation services.

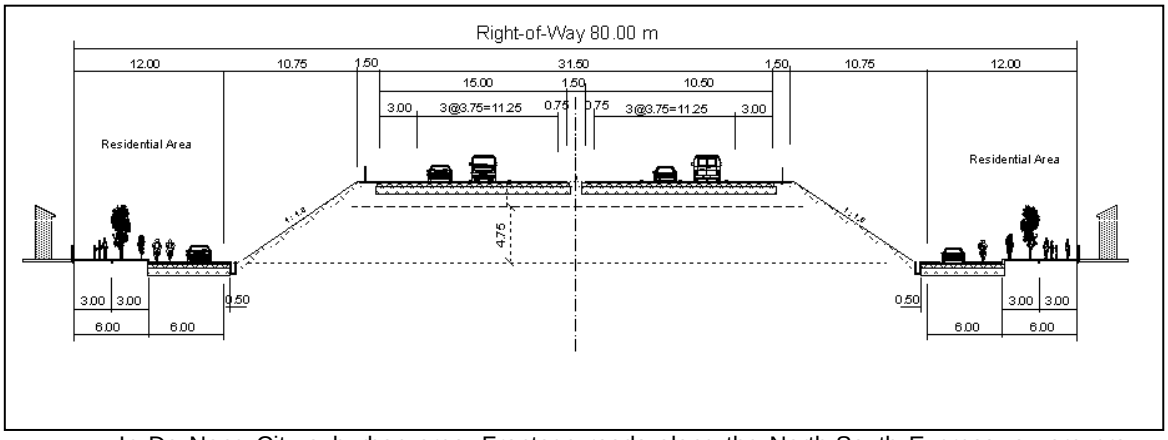
6.3 Urban Roads Planning and Development

1) Functional Classification of Urban Roads

6.22 Planning and development of urban roads must be done with due consideration of hierarchy of network connectivity with different level and function of the roads. In addition the urban roads in Danang City must consider adequate connectivity with national / regional transport network including expressway, national roads, high-speed railway, Vietnam Railway line, airport, sea port and river ports.

6.23 Inter provincial / national roads in Danang City will be developed in a way that they will not pass through urban areas to avoid conflicts and mixture with urban traffic. Proper design standards will be adopted and intersections with main urban roads are provided with adequate interchanges (see Figure 6.3.1 and Figure 6.3.2).

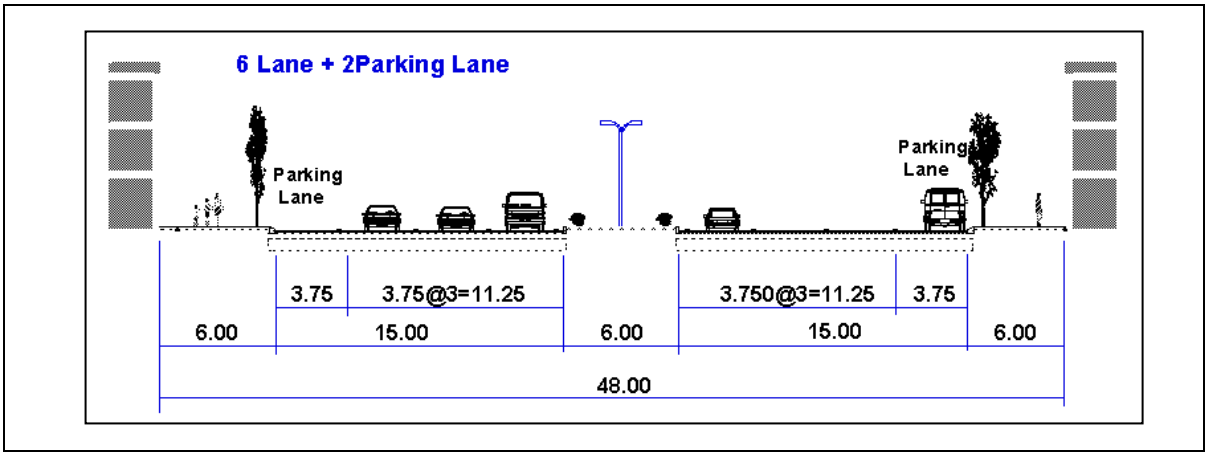
Figure 6.3.1 Proposed Typical Cross Section for North South Expressway in Danang City Area



In Da Nang City suburban area, Frontage roads along the North-South Expressway are proposed to expect a road side residential activity. Frontage roads will be necessary to ensure accessibility to these areas. These frontage roads will be designed for both local motorized traffic as well as pedestrian movement.

Source: DaCRISS Study Team

Figure 6.3.2 Proposed Typical Cross Section for Inter – provincial / National Roads in Danang City Area



Source: DaCRISS Study Team

6.24 To develop a proper road network, a systematic and hierarchical functional classification is necessary. The hierarchical classification of functions is composed of expressways, urban primary roads, secondary roads, and tertiary roads.

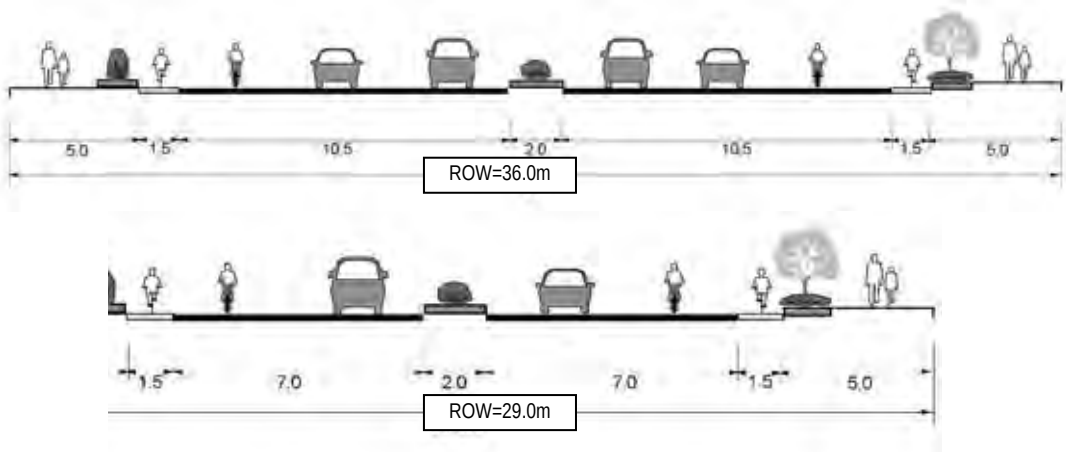
(a) **Urban Primary Road System:** The urban primary road system services the major portions of trips entering and leaving urban areas as well as the majority of through-way travel that wants to bypass the city center. In addition, significant intra-urban travel, such as between CBDs and outlying residential areas, between major urban core communities, or between major suburban centers, is served by urban arterials. For the proposed road network, the urban primary road is divided into major arterial system and minor arterial system. The major arterial system forms a significant framework linking up with the regional primary road network, while the minor arterial system provides trunk linkages between district centers and other sub-centers.

(b) **Urban Secondary Road System:** The urban secondary road system interconnects with and augments the urban primary road system. It provides services to travels with moderate trip lengths at a somewhat lower level of travel mobility than primary roads. This system also distributes travel to geographic areas that are smaller than those identified with those of higher road systems. Secondary roads must serve not only vehicular traffic but also various transportation and non-transportation activities.

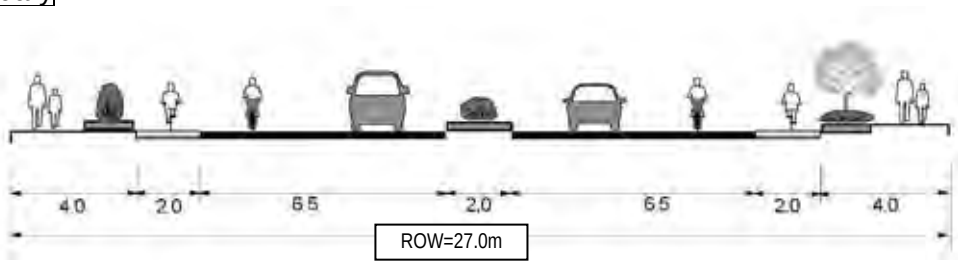
(c) **Urban Tertiary Road System:** The urban tertiary road system aims to provide access to areas located along the roads and to serve not only vehicular traffic but also non-motorized vehicle and pedestrian traffic as well as roadside non-transportation activities. Some urban streets that have commercial frontage serve fairly substantial volumes of traffic. However, this traffic is of terminal in nature; thus, it does not provide movement throughout the area.

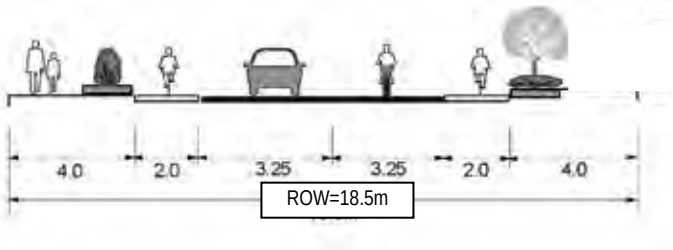
Figure 6.3.3 Proposed Typical Cross Section for Urban Roads

Urban Primary

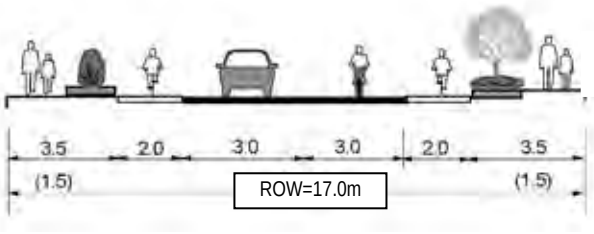


Urban Secondary





Urban Tertiary



Source: HAIDEP.

2) Design Standards

(a) **Design Standard:** "A Policy on Geometric Design of Highways and Streets" published by AASHTO has been widely referred to in the preparation of the geometric design standards in many countries, including Vietnam. In Vietnam, the Highway Design Standards (22TCN-273-01) was prepared in 2001. However, these standards are not universally followed by local engineers.

(b) **Design Speed:** Design speed is the maximum speed for safety travel that can be maintained for a specified section of a road and it is determined with respect to the terrain, adjacent land use, type of road, and the design speed of adjoining sections. The design speed will directly affect many geometric elements, like the horizontal and vertical alignments, sight distance, provision of super elevation, etc. Other features, such as lane width and shoulder width are also influenced by design speed.

Table 6.3.1 Design Speed

	Category or Class	Design Speed (km/h)					
		20	40	60	80	100	120
Inter – city Roads	N-S Expressway				●	●	●
	Primary Road (National road)			●	●		
Urban Roads	Primary Urban		●	●			
	Secondary Urban		●	●			

Source: Study Team.

(c) **Cross Section Design:** Cross-section elements are proposed based on Vietnamese standards (Urban road design standard TCXDVN 104:2007, Highway design standard TCVN 4054-05, Expressway–Design standard TCVN 5729-97), and consideration of road functions is based on traffic demand.

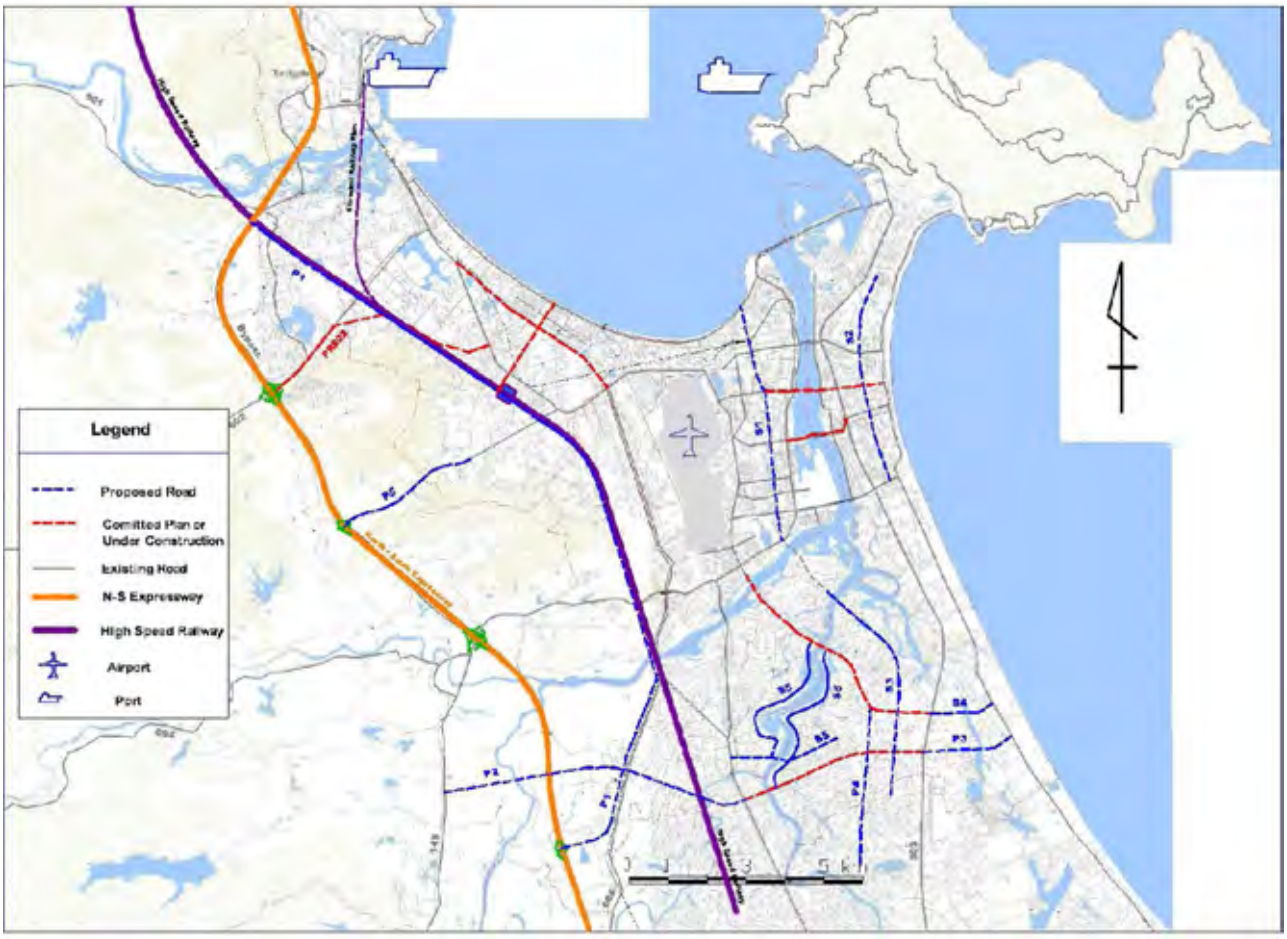
3) Proposed Primary Road Network

6.25 The existing primary road network should be expanded to cover and integrate the fast growing outer areas. Since the widening of the road in the urbanized area is basically very difficult, the proposed projects are mostly construction of new ones. The development of primary roads here is very crucial, as they should have at least 4–8 lanes with an adequate curbside and traffic control system.

6.26 In general, the density of arterial road network (including primary and secondary roads) in urban area is said to be about 3.5 km/sq.km. In grid network, an interval of arterial roads is 500–600 m. However, there are few cities where its arterial road network is completely developed. Therefore, for the urban area of Danang City, primary road is established in 1–2 km interval and it is supplemented by secondary roads to be formed grid type arterial road network. The location of the proposed road projects are shown in Figure 6.3.4 and Table 6.3.2 shows its list.

6.27 In Son Tra Peninsula, urban development as well as road development is restricted to conserve its natural environment. However, for the purpose of eco tourism such as hiking and bicycling as well as access of local residents, minimum transportation service by road is to be provided.

Figure 6.3.4 Location of Proposed Road Projects



Source: DaCRISS Study Team

Table 6.3.2 List of Proposed Road Projects

ID	Projects / Action	Length (km)	Width (m)	Scope	Cost (USD million / km)		
					Construction	Land	Total
P1	Danang Urban Bypass	21.7	48.0	New	3.6	1.9	119.4
P2	University Avenue (1)	7.7	48.0	New	3.8	1.5	40.8
P3	University Avenue (2)	2.3	48.0	New	2.1	1.9	9.2
P4	North-South Highway	3.9	48.0	New	3.7	1.5	20.3
P5	Access road of North–South Express-way – Bus terminal	4.3	48.0	Improvement	3.8	1.5	22.8
S1	North-South Highway 1	6.1	48.0	Improvement	4.2	31.0	214.7
S2	North-South Highway 1	5.4	33.0	New	1.7	5.5	38.9
S3	North-South Highway Extension	6.9	48.0	New	3.8	1.5	36.6
S4	Eastside Hoa Xuan – Ngu Hanh Son Road	1.9	33.0	New	2.1	1.9	7.6
S5	Westside Hoa Chau – Hoa Xuan - Ngu Hanh Son Road	11.4	33.0	New	2.6	1.9	51.3
DR601	Improvement of District Road No. 601	25.0	12.0	Improvement	1.0	0.0	25.0
DR604	Improvement of District Road No. 604	43.0	12.0	Improvement	1.0	0.0	43.0
Total		139.6	-	-	-	-	629.6

Source: DaCRISS Study Team

4) Intersections and Interchanges

6.28 When two intersecting roads each have four or more lanes, excluding the turning lane and the speed change lane, the intersection should be grade-separated, except where the traffic volume on the intersection, traffic safety condition, road network composition, interval between intersections, and topography allow an at-grade intersection.

6.29 In selecting the appropriate type of intersection, both traffic operation and economic aspects are considered. Then, too, the road network's hierarchy should be taken into account in accordance with a road's trafficability and accessibility (see Table 6.3.3). Figure 6.3.5 shows the interchange development concept.

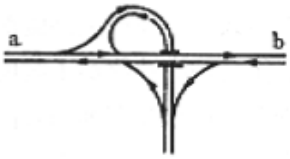
Table 6.3.3 Types of Crossing Structure

Intersecting Roads	Normal Arrangement
1. Expressway and Expressway	• Interchanges in all cases.
2. Expressway and Primary/Secondary	• Interchanges, without access where interchange spacing is too close.
3. Primary and Primary	• Grade separations.
4. Primary and Secondary Secondary and Secondary	• Intersections, but grade separations can be justified where capacity limitation causes serious delays, injury and fatality rates are high, and costs would be lower than an intersection.

Source: HAIDEP Study Team.

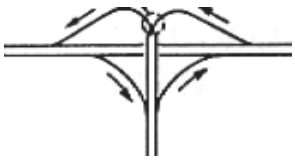
Figure 6.3.5 Interchange Development Concept

Trumpet Type (3-legs)



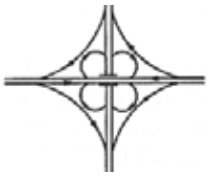
Source: www.penta-ocean.co.jp/.../tunnel/001.html

Y Type (3-legs)



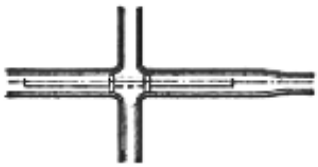
Source: jp.fotolia.com/id/5330018

Cloverleaf Type (4-legs)



Source: ja.wikipedia.org/wiki/

Diamond Type (4-legs)



Source: waikato.transit.govt.nz

5) Road Density

6.30 Road density is a key index of the road network's appropriateness for keeping a balance with land-use conditions. Target road densities corresponding to types of land use (see Table 6.3.4) have been introduced in various existing manuals. The HAIDEP urban road network plan also took into account road density in harmony with HAIDEP's proposed urban development plan especially the land use plan.

Table 6.3.4 Example of Target Road Density in Urban Area

Land Use	Target Road Density (km/km^2)
Residential	4
Commercial	6
Semi-Industrial	2
Industrial	1

Source: Ministry of Construction, Japan.

6) Road and Facility Maintenance

6.31 Urban primary road and Secondary road also require suitable maintenance management. These include traffic control, traffic information and emergency services, processing of traffic accidents. Routine and periodic maintenance work is also important.

6.32 The current situation of the operation and maintenance for roads in Vietnam is classified into three, namely national road, urban road and Expressway. National road is managed by the MOT, and the city road is maintained by City Authority. They use public executing corporations. An appropriate system of the operation and maintenance is examined in consideration with such situation.

Table 6.3.5 Outline of Road Operation and Maintenance Organization

Road Classification	Jurisdiction	Execution	Fiscal Resource
National Roads	MOT	Contract out basis	State Budget
City Roads	City authority	Contract out based on the public corporations	Local Budget
Expressway including BOT Projects	Private Company or BOT Bodies	Force account (partially contract out basis)	Toll Collections

Source: DaCRISS Study Team.

6.33 Maintenance works are classified into three types: routine, periodic and emergency. Table 6.3.6 summarizes typical activities of each type of maintenance work. Figure 6.3.6 shows the general flow chart of the recommended overall maintenance works.

(i) **Routine maintenance**: This is based on routine (daily) inspection of the condition of pavement, cut and fill slopes, drainage, bridges and other structures and facilities to monitor any defects and damage. The results of routine inspection will be promptly reported to the maintenance office for follow-up maintenance works to be undertaken either continually throughout the year or at certain intervals annually.

(ii) **Periodic maintenance**: This is based on detailed inspection performed at certain time intervals such as seasonally or yearly depending on the type and kind of facilities. It includes checking and testing the conditions of various structures and facilities.

Defects and damage will be reported for repairs or remedies.

(iii) **Emergency maintenance**: This basically comprises works to restore road and road related facilities to their normal operating conditions after they are damaged by road accidents or natural calamities. It is impossible to foresee the frequency, but such maintenance requires immediate action.

Table 6.3.6 Typical Maintenance Activities

Type	Activity
Routine	Inspection and patrol including removal of obstacles
	Clearing of road surface
	Clearing of ditches, culverts and bridges
	Vegetation control; Mowing and maintaining of plants
	Repair of traffic safety and management facilities
	Repair of devices and equipment including lighting facilities
	Pothole patching and crack sealing
	Repair of cut and fill slopes
Periodic	Inspection and test
	Renewal of traffic safety and management facilities
	Renewal of devices and equipment
	Overlay and re-pavement for bridges
	Replacement of expansion joints and bearing for bridges
	Repair of ditches, culverts and bridges
Emergency	Removal of debris or obstacles from natural causes
	Repair of damage caused by natural causes
	Repair of damage caused by traffic accidents

Source: DaCRISS Study Team

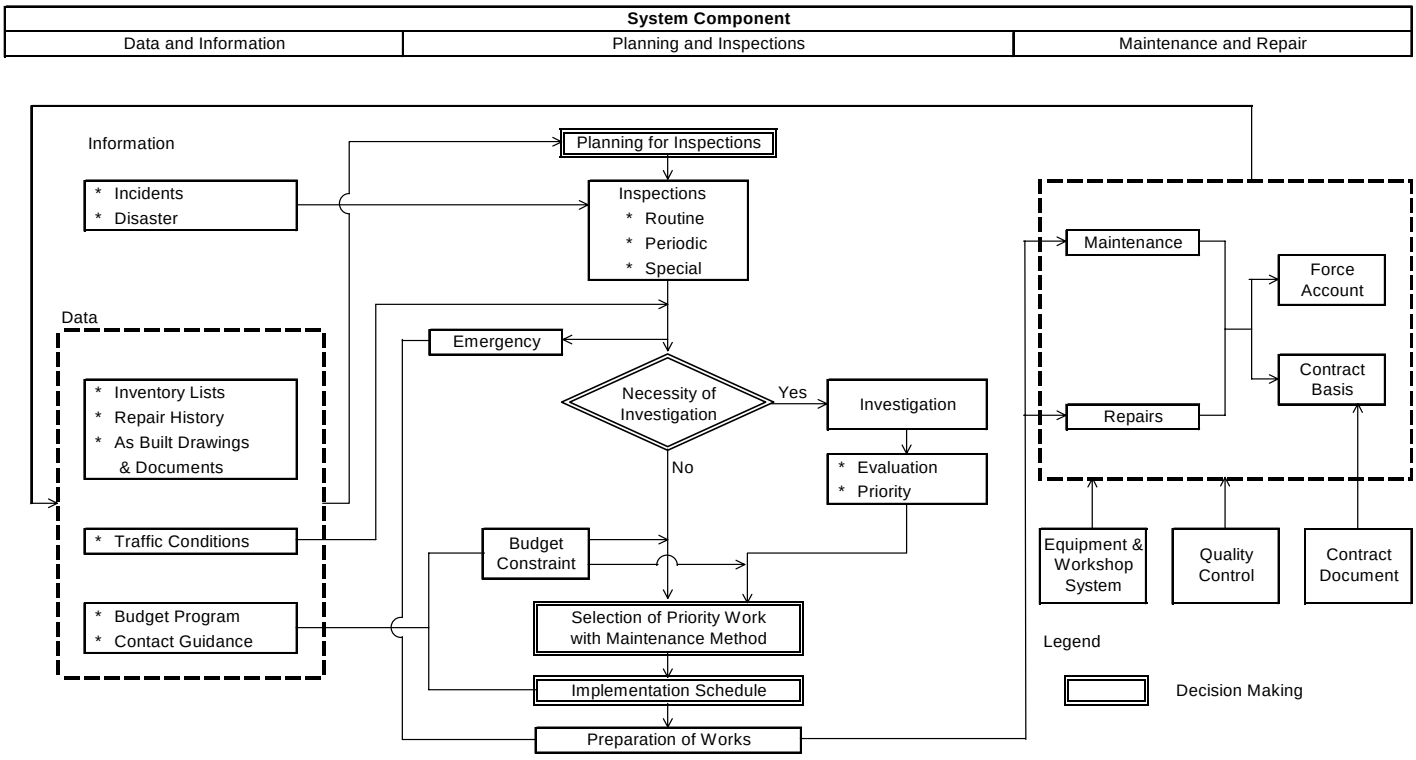
6.34 Figure 6.3.6 shows the general flow of maintenance works. Maintenance works in Danang City are as follows:

(i) **Data and Information:** This is mainly managed by DOT, specifically under the Division of Traffic Management. .

(ii) **Planning and Inspections:** This is jointly managed by DOC, DOT, and DPI. DOC and DOT coordinate in the stage of planning, assisted by UPI as well. In DOT, this is specifically managed under the Division of Planning and Investment.

(iii) **Maintenance and Repair:** This is jointly managed by DOT, DPI, and DOF. In DOT, this is specifically managed under the Division of Planning and Investment, Division of Traffic Management, and the Division of Quality Control. The work is also supported by the Road Management Company under DOT, and PMUs for individual projects as well.

Figure 6.3.6 General Flow Chart of Maintenance Works



Source: DaCRISS Study Team.

6.4 Traffic Management and Safety

1) Traffic Management Process

6.35 With the number of vehicles in the city expected to grow in the coming years, traffic congestion will become more serious. Already, travel time is increasing due to congestion at bottleneck points and traffic accidents have become a serious social problem. Simply constructing new roads or widening existing ones cannot solve this problem, even if funds are available. This situation calls for greater reliance to be placed on a more efficient and effective use of the existing road network. To achieve this and to realize efficient and safe traffic, traffic management plays a vital role.

6.36 The objectives of traffic management are twofold: (i) enhance mobility, accessibility, and safety, and (ii) support public transportation for better and effective services. These objectives can be achieved through the traffic management process.

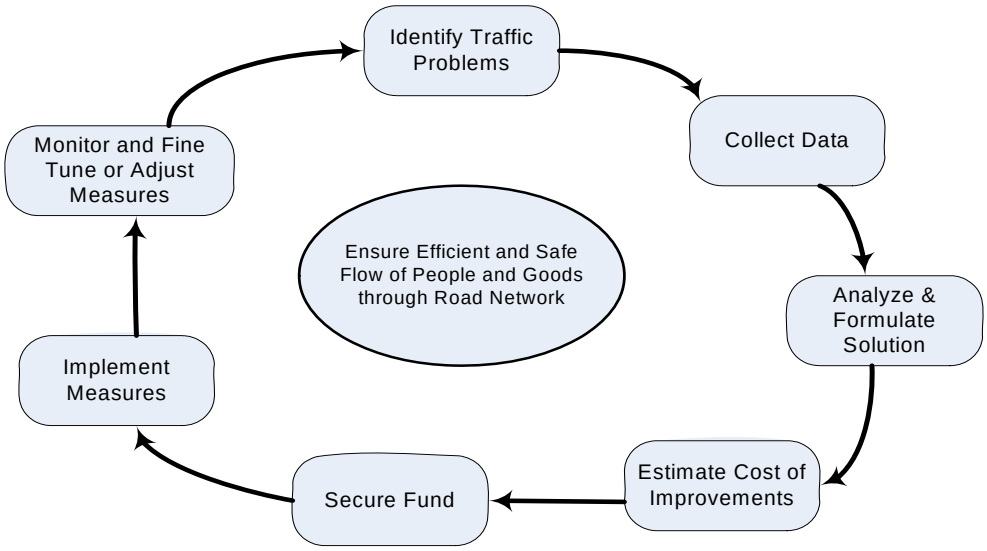
6.37 Traffic management process is an ordered group of related tasks and activities performed sequentially and repetitively to solve or alleviate traffic problems. Traffic conditions are not a static phenomenon; they gradually change over time with more motorcycles and cars joining the traffic and with the road network improving and expanding. Thus, it is important to establish a mechanism in which the traffic management process can be regularly re-examined to cope with the changes in traffic.

6.38 The process is shown in Figure 6.4.1. It normally starts with the identification of traffic management problems and issues. The cause of problem is then analyzed based on the data collected and a solution is formulated, which may include a hard component, like intersection geometry improvement or signal installation, and a soft component such as traffic discipline campaign or stricter enforcement. Since any traffic improvement measure will incur cost, it must first be estimated and the budget must be secured before implementation. It is important to review the results of the measures to judge their effectiveness and to accumulate experience and knowledge.

2) Classification of Traffic Management Measures

6.39 There are a variety of traffic management measures. Some of them intend to improve efficiency, while others aim to enhance safety. Table 6.4.1 lists them by applicable area. It is noted that one measure can be applied to intersection, corridor, or area. Moreover, most of the measures can be applied in combination with other measures to get maximum benefits.

Figure 6.4.1 Traffic Management Process



Source: HAIDEP Study Team.

Table 6.4.1 Classification of Traffic Management Measures

Area	Category	Measures
Intersection	Geometric Improvement	• Geometry, island, channelization, median, lane assignment • Wheelchair slope
	Signal	• New signal • Signal phase and timing updating • Flasher
	Marking	• Stop line, pedestrian crossing, lane line, directional arrow
	Regulation	• Turning restriction
	Public transit	• Transit signal priority • Exclusive bus lane at approach • Exemption of left turn ban
	Others	• Curve mirror, lighting
Corridor	Segregation	• Median, separator
	Pedestrian	• Mid-block pedestrian crossing
	Sidewalk	• Widening, guardrail, pavement, tree & plant
	Pavement marking	• Lane line, mid block pedestrian crossing,
	Regulation	• One-way, speed limit, truck ban, no parking, pedestrian mall, transit mall • Reversible lane
	Demand management	• Exclusive/priority bus lane • High occupancy vehicle (HOV) lane
	Sign	• Regulatory sign, guide sign
	Parking	• No parking, paid parking, free parking
	Public transit	• Exclusive/priority bus lane • Contra-flow bus lane
	Others	• Street lighting
Area	Demand management	• Traffic cell • Pedestrian mall, transit mall • Road pricing • Truck ban
	Signal	• Area traffic control (ATC) system
	Information	• Traffic information system • Parking guidance system
	Regulation	• School zone

Source: HAIDEP Study Team.

3) Traffic Control and Regulations

6.40 In the road network plan proposed in the previous section, each road project supposed to include not only construction of road infrastructure but also installation of road facilities related to the traffic control and safety such as traffic signal, etc.

(a) **Traffic Signals:** Installation of traffic signals is to make a traffic flow efficient and safe. The Danang Traffic Signal Control System Project assisted by Spanish ODA is being implemented as short-term action to improve the current traffic control system in the city. The project will signalize 77 intersections, install cameras at 20 intersections and establish a control center at the office of Danang Traffic Police Department. The designated 77 intersections cover the most of present urbanized areas of Danang City. Therefore, for the time being, it is essential to facilitate the implementation of this project.

(b) **Traffic Regulations:** The existing truck ban shall be continues with appropriate modifications of designated routes and time periods in accordance with the changes of traffic conditions on the primary road network. One-way traffic operation may be effective to increase the road capacity, particularly in the city center where road density is high and a pair of streets is traversing closely in parallel.

4) Parking Policy

6.41 At present, car parking is not a serious problem in the CBD of Danang City. However, motorcycle parking has spread over sidewalks in the city center. Under the trends of vehicle ownership increase and new high-density development, parking will quickly become a critical issue. It is about time to establish a parking policy. Practical development strategies and management practices will help alleviate the impact of parking within the CBD.

6.42 On-street parking policy first tackles the spill-over situation of motorcycle parking through the combination of two actions:

(i) First, on major retail and tourism streets, motorcycle parking shall be prohibited and sidewalks will be returned to pedestrians regardless of the width of sidewalk.

(ii) Second, roads and sidewalks in close proximity to the above streets, where less pedestrian traffic is observed, can be designated as parking area.

6.43 The city should soon identify and establish roads that permit or prohibit on-street parking within the CBD. The principle is that on-street marking provides a space for short-time parking demand in the CBD. For the roads allowing on-street parking, it is important to charge parking fees comparable with, or even higher than, garage parking fees in the same area. Otherwise, drivers would crowd the streets instead of using garage parking.

6.44 The off-street parking plan should be in the context of land-use development. Identifying and reserving land for public parking structures is a component of the city's land-use plan. The private sector is perceived to have a significant role in developing parking structures through public-private partnership, as experienced by both developed and developing cities.

6.45 A parking provision shall be established and incorporated into the review process of land development. Such requirement needs to differentiate parking rates according to the trip generation and attraction nature of the proposed land use.

5) Local Traffic Improvement

6.46 While the proposed road network attends to the improvement of transportation infrastructure and services at the city level, it is also important to look into transportation service at the district level, because a significant portion of the transport demands is met within the districts, especially in suburban areas. While the overall assessment of the trips is affirmative except for a few, the people's assessment of specific areas is rather negative, especially safety followed by roads, travel conditions, and public transport services. Since conditions and concerns of the people vary by district and even by narrower traffic zone, the measures to be taken differ from each other. However, a common approach to district-level transport improvement is to employ the issue comprehensively as a component of overall urban and community development and improvement.

6.47 Specific Items to be covered by this improvement are proposed as follows and cost for a series of improvements is tentatively assumed approximately US$100 million:

(i) Road pavement improvement
(ii) Intersection geometric improvement
(iii) Sidewalk improvement
(iv) Road marking improvement (lane line, stop line, pedestrian crossing, etc.)
(v) Traffic sign and information
(vi) Traffic safety facilities