

# **Da Nang urban structure: the motorcycle, provides a significant advantage for mobility and housing affordability**

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*This report is based on interviews, field visits and data collected during a visit to Da Nang with a World Bank mission in July 2010. I have also used data from the Da Nang Bus Rapid Transit pre-feasibility study (G. Neilson oct 2010) and the draft report “Urban Planning, Land, and Housing –Vietnam Urbanization Review” by Urban Solutions BV, ALMEC and GHK feb 2011). The bulk of the information on land use and housing has been obtained by interpreting and vectorizing Google Earth images dated from 2002 to 2010. Densities were obtained by overlapping census tract data with the built-up area measured from Google Earth images.*

## **1. Urban planning main objectives: improving labor mobility and housing affordability as the city expands**

A spatial development strategy for Da Nang should have two main objectives:

- 1) Improving mobility, and
- 2) Providing affordable land and housing in areas located within less than 45 minutes travel time to the location of major jobs concentration;

Any recommendation for government action, whether it concerns infrastructure investment, transport, or urban regulations, should be tested by measuring its impact on mobility and affordability.

Land use, densities, and the direction of spatial expansion are mostly defined by the interaction between the real estate markets and government road investments. By contrast, mobility depends very much on government investments in roads, traffic management and when necessary by investments in public transport and subsidies of transit operations.

Land and housing affordability is very much dependent on land supply elasticity, itself largely dependent on primary infrastructure and urban transport development financed by government. In addition, the government has a major responsibility in developing responsible traffic and land use regulations that would facilitate mobility and housing affordability. Land use planning is therefore

confronted with a circular relationship between market driven supply and demand for land and floor space, and government intervention in infrastructure and regulations.

There is no known land use or spatial arrangement that would optimize both mobility and affordability. Economic, topographic, and cultural factors, and more generally the dynamism of the real estate market are important in determining the spatial strategy that the government should adopt to ensure mobility and affordability.

## *2. Da Nang spatial structure and its implication for mobility and affordability*

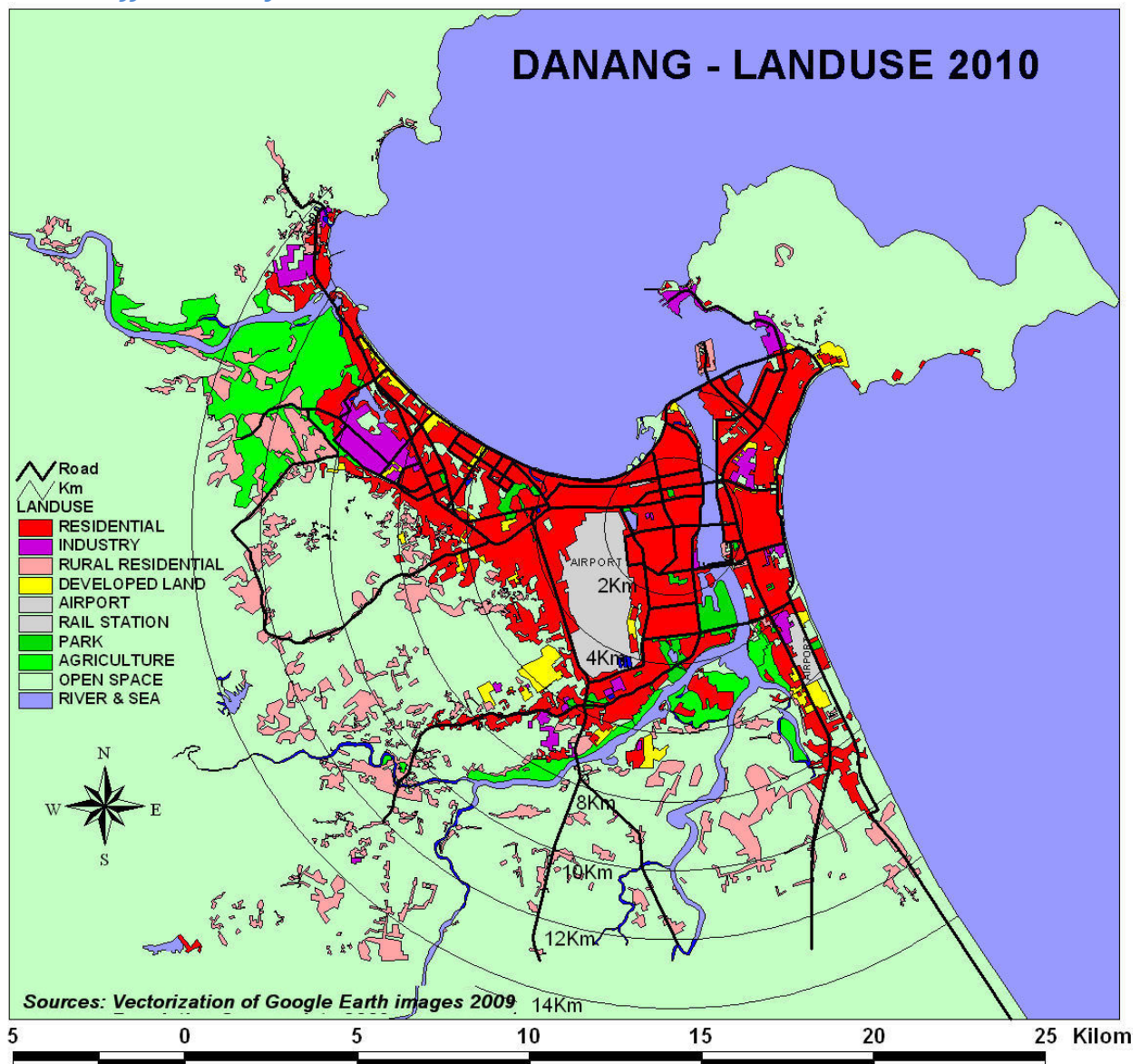


Figure 1: Map of Da Nang built-up area

*Da Nang topography is the major determinant of its spatial expansion*

The peculiar topography of Da Nang is a determining factor in selecting a spatial strategy. The land use map shown on *Figure 1* shows the complexity of Da Nang topographical constraints, compounded by the presence of the main airport in the middle of the built-up area. Da Nang is developing mostly along the edges of the Han River and along the coast. The airport location and the hilly topography penalize any significant growth toward the South West. The decision to develop Da Nang as a major resort town to take full advantage of its sand beaches further reinforce the linear development of the city along the river and the coast. The newly developed Nguyen Tat Thanh road along the northern beach with a 40 meters right of way and four lanes of traffic will further reinforce the linear development of the city.

*Densities in the built-up area of Da Nang are likely to increase in the future*

At 88 p/ha, the average density in the built up area of Da Nang is relatively low by Asian cities standards (compared with 142 p/ha in HCMC and 188 p/ha in Hanoi). However, observation of Google Earth imagery (dated feb 2010) shows that the density is likely to increase significantly in the years to come as many of the lots in newly developed areas are still unbuilt. The local government has recently invested in primary road extensions along the northern beach and in formal land subdivision in areas adjacent to the new infrastructure. A sample of 9.3 hectares in a newly developed formal residential area selected at 6 km from the CBD shows that only about 23% of the lots are currently built. There are currently many similarly developed areas in Da Nang that have not reached their full potential built density. When these areas are fully developed and built with typical town houses of 4 floors the average built up density of the city is likely to increase significantly. As shown on *Figure 1*, the topographical constraints represented by the sea, the rivers, the swampy low-lying areas and the nearby hills will significantly reduce the potential supply of land in the future to allow for urban extension. This constraint of land supply would suggest higher land prices, higher rents and consequently higher population densities in the future.

The spatial pattern of densities in the built-up area of Da Nang shows high densities (200 to 400 p/ha) only around the current CBD (*Figure 2*) but densities are falling quickly to 60p/ha or less beyond 5 km from the city center. The profile of densities shown on *Figure 3* confirms the sharp fall in density at a distance of about 5 km around the city center. This type of steep density gradient would imply that at present Da Nang is strongly monocentric, i.e. that a large number of jobs and amenities are concentrated in the CBD attracting the majority of trips. This pattern of densities combined to the linear shape of the built up area would suggest an advantage for the operation of transit as employment areas seems highly



concentrated around the current CBD. However, because of the large areas that are already developed but only partially built it is likely that the average density will soon increase and that jobs and amenities will disperse in areas made highly accessible by the new infrastructure built by the local government.

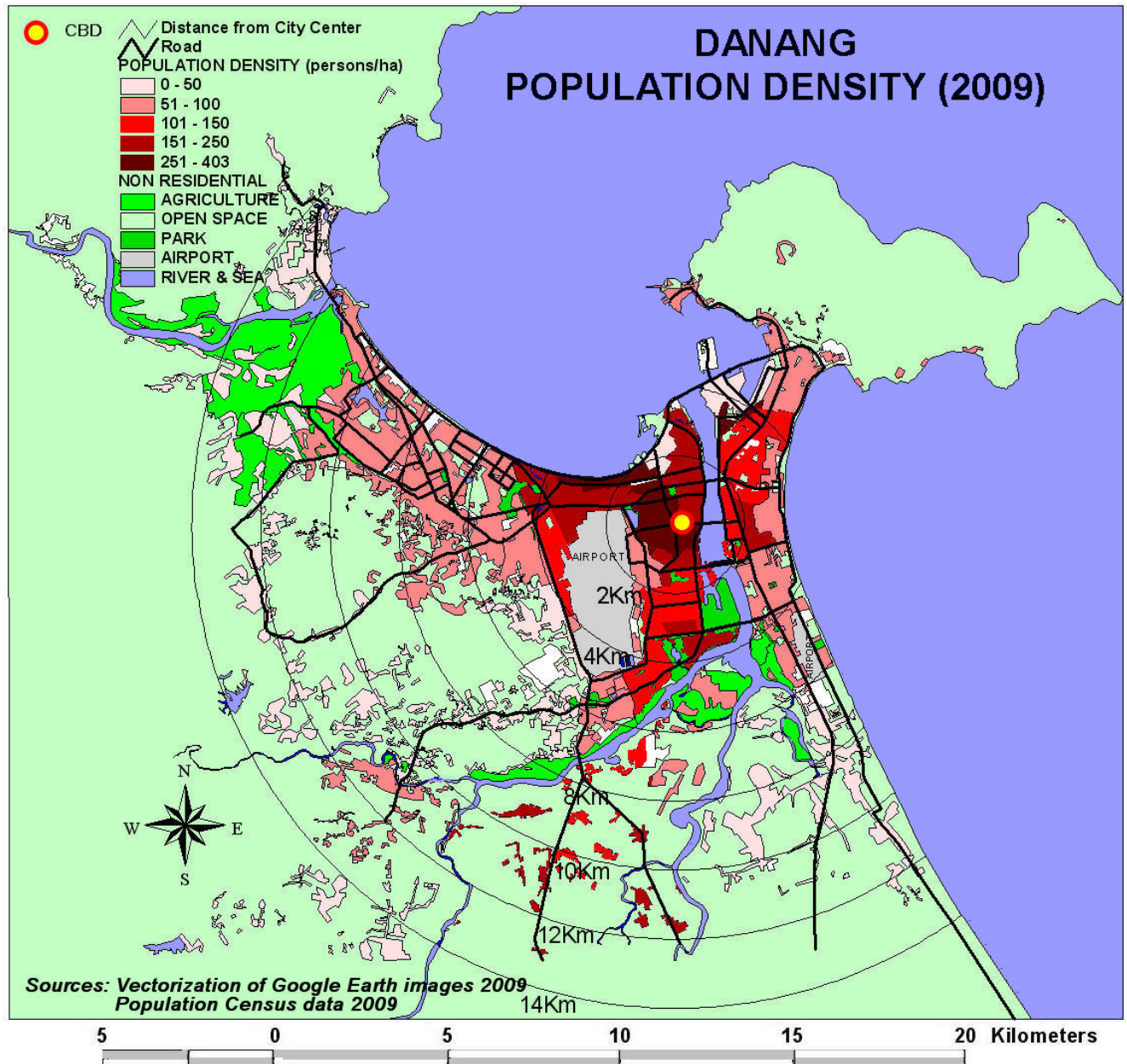
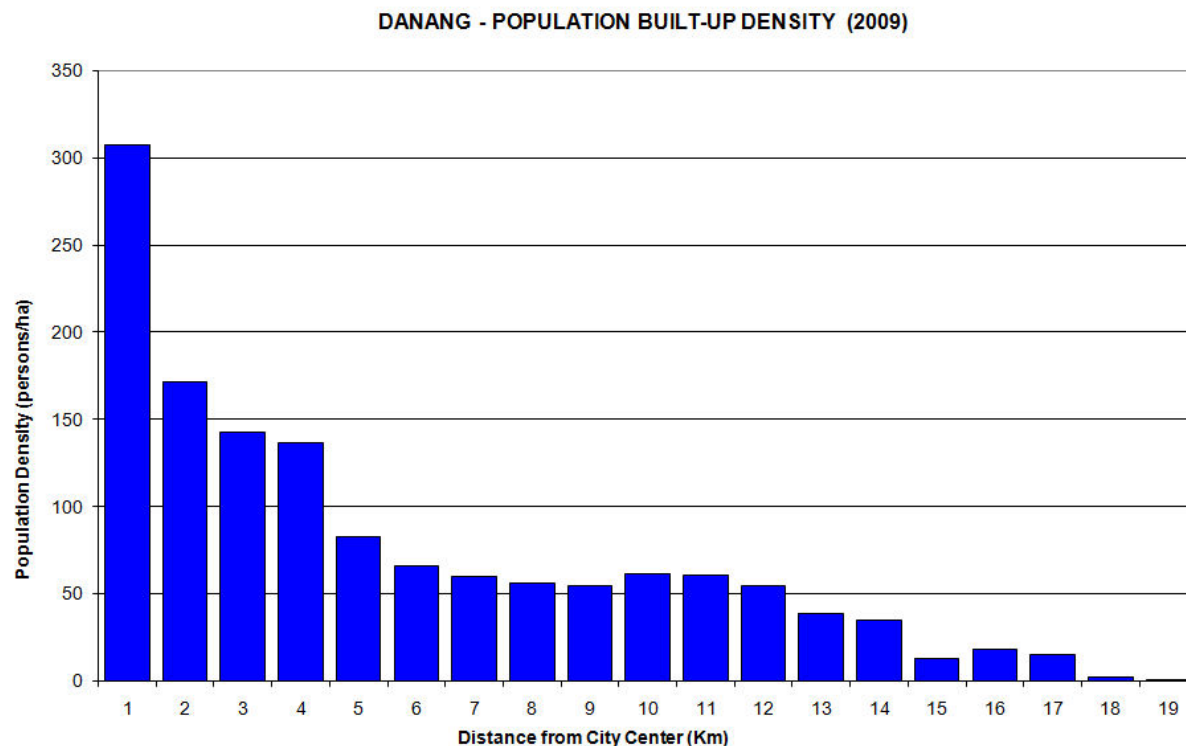


Figure 2: Da Nang - Population densities in the built up areas



Sources: Population: census 2009

Built-up area: vectorization of Google Earth image 2008-2009

**Figure 3: profile of population densities by distance from the city center**

The government has recently expanded the network of primary roads along the northern beach area while developing adjacent areas with a formal road network. The lots in these developments have recently been allocated, are not yet fully built and as a consequence the density has not reached yet its saturation point. The aerial view shown in the left side of *Figure 4* shows a recently developed area where only 23% of the lots were currently built. The land use table shown on the right side of *Figure 4* estimates the current density (152 p/ha) and the future projected density (650 p/ha) of a typical new formal development, assuming an explicit projected value for a number of parameters as households sizes and floor area per person displayed in the table. In these new types of formal subdivisions, each lot is around 100 m<sup>2</sup> fronting street varying in width from 10 to 14 meters, providing therefore excellent car access and possibility of on street parking. This type of formal subdivision is likely to be only affordable to high income households<sup>1</sup> because of the proximity to the beach front, the proximity of the city's primary arterial roads and because of the wide residential access streets that are

<sup>1</sup> Some of these Government sponsored subdivisions might be relocation projects for households displaced by major public works and the income of the relocated people might not necessarily be high. However, what makes the market value of a parcel of land is not the income of its current owner but its location. The lots in these subdivisions when put on the market will reach high prices because of their location, high accessibility and high infrastructure standards.

uncommon in many residential areas of Da Nang. The land price survey conducted by USBV, ALMEC, GHK <sup>2</sup> in February 2011 found that floor prices in this area are currently around 23 million VND/m<sup>2</sup>. Given the excellent city accessibility, the proximity from the beach and from the planned new CBD (see *Figure 6*) it is likely that these prices will keep rising when residential lots bid prices will compete with hotels and commercial use when the future potential of the beach will be fully reached in the near future.

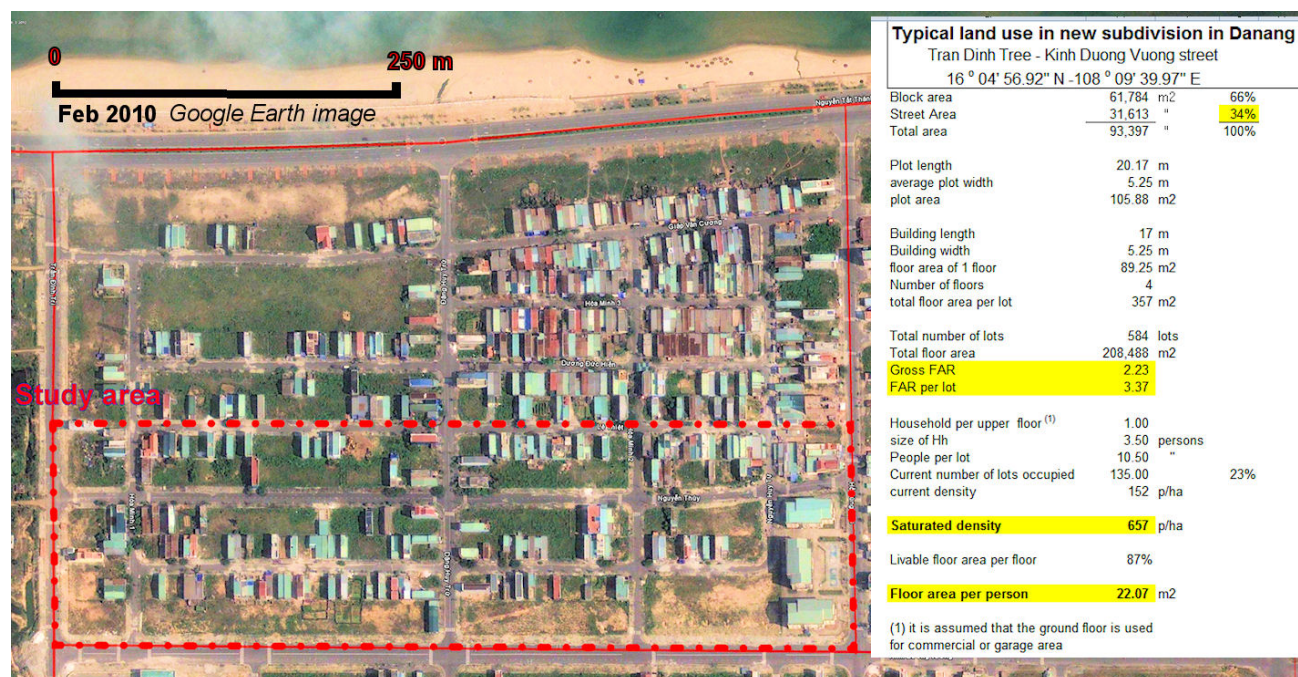


Figure 4: typical town houses formal subdivision in process of densification

Another type of densification is taking place informally away from the most expensive areas of the city shown in the preceding example. *Figure 5* shows two stages of development of the same area between 2002 and 2010. The process of expansion and densification, as shown on *Figure 5*, has been facilitated by a widening of an existing road (Hoang Van Thai) from 5 meters to 14 meters. The low density semi-rural development that existed in 2002 (upper part of *Figure 5*) has been replaced by a relatively dense subdivision of lots, smaller than the formal lots shown in the preceding formal example (around 60 m<sup>2</sup> lots with built area per floor of 50 m<sup>2</sup>). The width of internal streets, following former rural lanes, varies from 2 to 5 meters, allowing the circulation of emergency vehicles and motorcycles but not individual cars' circulation or on street parking.

<sup>2</sup> Urban Planning, Land, and Housing – Vietnam Urbanization Review, by Urban Solutions B.V. ALMEC and GHK, prepared for the World Bank, draft report February 2011.





***Development along Hoang Van Thai road in October 2002***



***Development along Hoang Van Thai road in February 2010***

Figure 5: typical town houses informal development



The land price and rents in this type of informal development and location was not covered by the land and housing price survey mentioned above. However the type of housing and its location allow us to infer that this type of development, while providing adequate housing, will be likely to remained low cost in the future because of the impossibility of providing car access to individual lots. The farther the distance from the main feeder vehicular road (shown along the diagonal of the 2 views of [Figure 5](#)) the lower the likely price or rent currently and in the future.

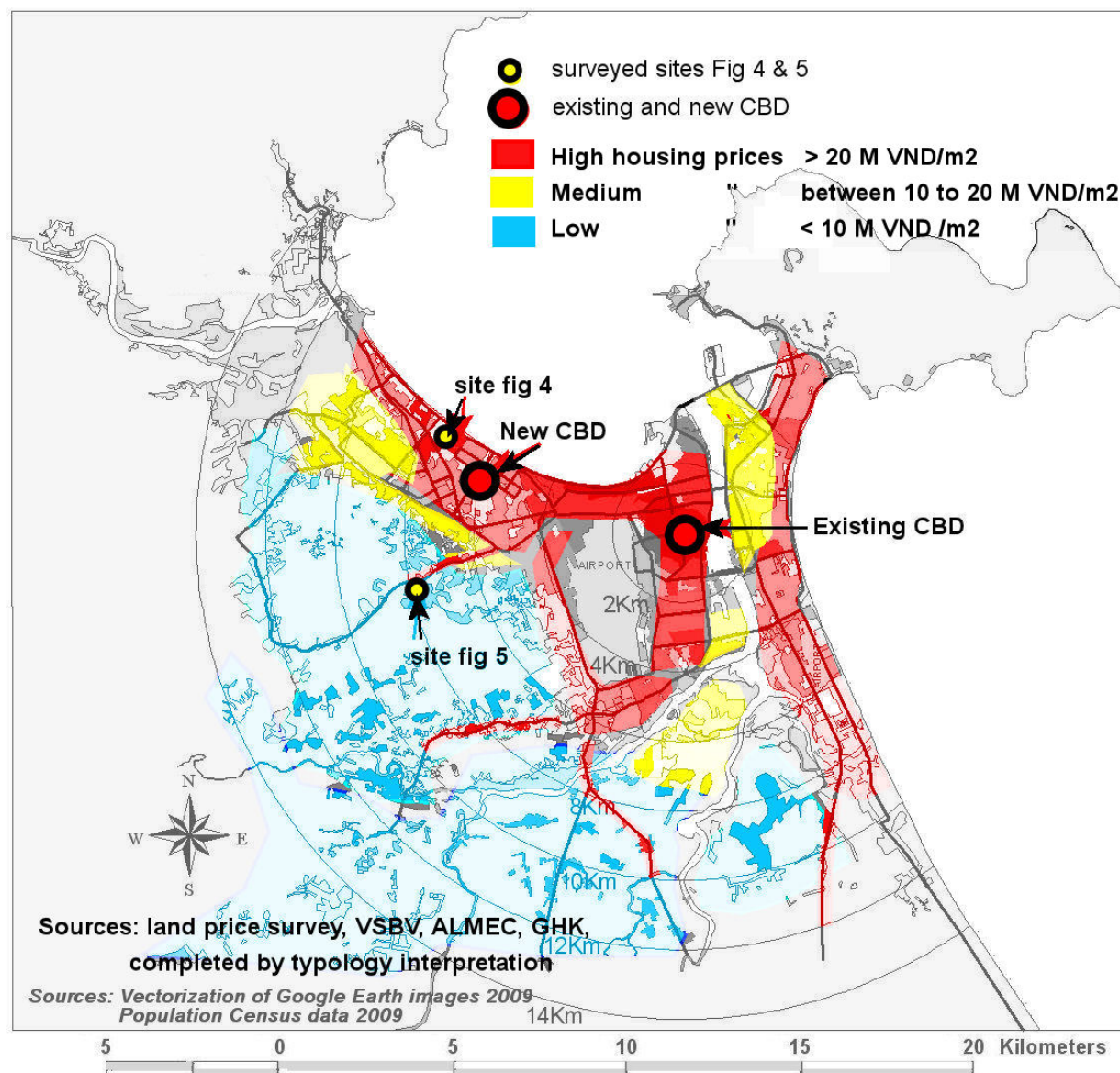


Figure 6: Da Nang: likely current distribution of housing price per m2



The price data, the housing typology and the aerial photo interpretation discussed above allow us to draw a schematic representation of the likely spatial distribution of land prices, rent and household's income in the future. The map shown on *Figure 6* shows a simplified view of residential price per m<sup>2</sup> of floor space in various areas of the city. This map is largely based on the land price survey quoted above and has been completed by an interpretation of the housing typology derived from Google Earth imagery. The geographical pattern of housing price shown on *Figure 6* is of course simplified but is probably accurate in establishing the hierarchy of prices between areas and therefore provides a strong hint at the probable location of households by income groups.

Because of the strong tourism economic base of Da Nang, actively supported by large public and private investment, the highest land values are found around the current CBD and along the beach areas. The primary infrastructure recently developed reinforces this spatial pattern of housing price toward the northern and eastern part of the city. The areas further inland toward the hills located in the south West of town are less developed in term of access and less attractive for development although their proximity to the high land values areas make them easily accessible by motorcycle to job locations and formal areas. It is likely that part of the areas colored in blue of the map of *Figure 6* will be eventually developed informally and will provide affordable housing to the lower income population of Da Nang, in particular to migrants coming from rural areas. The spatial distribution of land and housing prices should be verified and monitored by systematic land and rent price surveys based on a detailed housing typology.

#### *Housing affordability and location*

The informally developed areas, while providing a type of housing not structurally very different from the more expensive areas of Da Nang, constitute an important supply of low cost housing that has the advantage of being demand driven. The future population densities of these low income areas will depend on their possibility of further extensions in the future. The increase in the supply of affordable housing could be facilitated by the construction of new government built vehicular feeder roads similar to the widening of Hoang Van Thai road discussed above.

However, the current master plan doesn't include the development of land in the areas where land is the cheapest and where we can detect demand (*Figure 7*). The intention of the master plan was probably to avoid the development of these areas because they are hilly and more expensive to develop than the flat areas along the coast and river. Given the heavy constraint in Da Nang on developable land supply – constraint due to the topography compounded by the central location of the airport – there is not much choice but to allow the informal

development of the South West while guiding it by providing arterial roads with a right of way around 15 meters at about 500 meters intervals. Within the blocks created by these arterial roads, land subdivision and house construction should follow the pattern traditional to Vietnam (multistory town houses with a 4 to 5 m frontage), letting the market allocate land between roads and private lots.

Government should purchase land in these future dense low income areas for social facilities as it is done in formal areas. This informal process supported by government investments will allow the private supply of houses affordable to the lowest income groups.

Danang Development Master Plan to 2020



Figure 7: Current Da Nang Master Plan: Land use for 2020

If the government decided to discourage in the future this type of spontaneous affordable development, the density in the existing informal areas would increase, making the basic urban services (refuse disposal, drainage, and social services) more difficult and expensive to provide in the future.

The two types of settlements shown in *Figure 4 and 5* are typical of most residential areas of Da Nang. Both types (and intermediary types) should be allowed to develop. Predicting at what densities and in which part of the city these settlements are likely to develop will be essential in meeting the two main



objectives we defined at the beginning of this report: maintaining labor and consumers' mobility and insuring housing affordability for all.

### **3. Da Nang spatial structure, labor mobility and urban transport**

Mobility in Da Nang appears to be excellent now, thanks to the new primary roads recently built by the government. Motorcycle trips dominate transport modes. According to the recent Transit Feasibility Report<sup>3</sup> prepared for Da Nang, 77% of trips are done by motorcycle and 22% by bicycle, which leave only 1% for trip by buses and private cars (the non-two wheelers share of trips seems extraordinary low to me, but anyway two wheelers are undoubtedly highly dominant). As in other cities of Vietnam, the motorcycle provides a high mobility and accessibility to any part of the built-up area that in the long run will tend to disperse the location of jobs. The motorcycle has the big advantage of providing adapting trip to changing land use, in particular when jobs dispersed away from the traditional CBD.

Da Nang appears to have no traffic problem at the moment. A quotation from the transit report summarizes the situation in Da Nang:

“The street network in Da Nang has many wide roads which at present are operating well below capacity. It would appear however that with the increase in population, increases in private car usage and increases in average trip length the road network will become steadily more congested in the coming years.

Speeds on motorcycles today are relatively high and it is unlikely that any BRT route would be able to operate faster than motorcycles today. This however is likely to change in the coming years.”

The main concern is that as households' income increase, a number of motorcycle trips will be replaced by car trips, using about 4 times more street space per trip shifting from motorcycle to cars. The strategy advocated by the transit feasibility report could be summarized as follow:

1. Cars trips will progressively replace some motorcycles trips
2. At current densities and road space Da Nang will then become severely congested by this shift in transport mode,

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<sup>3</sup> “Da Nang Bus Rapid Transit Pre-Feasibility” Study prepared by Gordon K Neilson (October 2010), final draft stage 2 report prepared for the World Bank

3. The only solution is to introduce a BRT network that will allow motorcycle users to switch to transit, saving road space for the growing cars users.
4. The creation of BRT lanes will severely disturb existing motorcycle traffic by reducing the lanes available for motorcycle traffic on the main avenues and by preventing most motorcycle left turn, this will make the BRT more attractive to other motorcyclist in the long run.

The report is obviously not oriented toward improving mobility but finding in which circumstances the construction of a BRT could be justified (which seems to be correctly responding to its terms of reference).

The table shown on *Figure 8*, extracted from the transit feasibility report is very explicit about the congestion that the BRT will create.

**Table 6.1 Forecast GDP and Car Ownership, Traffic Composition, Road Capacity and Vehicle Speeds**

DANANG BUS RAPID TRANSIT  
PRE-FEASIBILITY STUDY  
Prepared by Gordon K. Neilson  
October 2010  
FINAL DRAFT STAGE 2 REPORT  
Prepared for THE WORLD BANK

Dien Bien Phu (pm Peak Hour)												Existing lane arrangement		w/ BRT	
Year	Pop (m)	GDP growth (%)	GDP (USDm)	GDP/ capita (USD)	Cars/ 1000 pop.	pphpd	% by car	% m/c	% city bus	% other	total pcu	v/c	general traffic speed	v/c	general traffic speed
2006	0.793		812	1027	5.7										
2007	0.806	17%	951	1180	7.3										
2008	0.821	11%	1056	1287	8.3										
2009	0.835	12%	1182	1416	9.5										
2010	0.850	10%	1301	1530	10.7	17208	2.0%	95.5%	1.50%	1.0%	3002	0.52	31.36	0.69	25.42
2011	0.866	10%	1431	1653	12.0	17518	2.2%	95.2%	1.50%	1.0%	3084	0.54	30.92	0.71	24.71
2012	0.881	10%	1574	1786	13.4	17833	2.5%	94.9%	1.50%	1.0%	3170	0.55	30.44	0.73	23.94
2013	0.897	10%	1731	1930	15.1	18154	2.8%	94.2%	1.88%	1.1%	3261	0.57	29.94	0.75	23.12
2014	0.913	10%	1904	2085	16.9	18481	3.2%	93.5%	2.25%	1.1%	3357	0.58	29.38	0.78	22.22
2015	0.930	10%	2095	2253	19.0	18813	3.6%	92.7%	2.63%	1.1%	3460	0.60	28.78	0.80	21.25
2016	0.946	10%	2304	2435	21.3	19152	4.0%	91.9%	3.00%	1.1%	3570	0.62	28.13	0.83	20.18
2017	0.963	10%	2535	2631	23.9	19497	4.5%	91.4%	3.00%	1.1%	3690	0.64	27.40	0.85	18.99
2018	0.981	10%	2788	2843	26.8	19848	5.0%	90.8%	3.00%	1.2%	3819	0.66	26.59	0.88	17.68
2019	0.998	10%	3067	3072	30.1	20205	5.6%	90.2%	3.00%	1.2%	3959	0.69	25.70	0.92	16.22
2020	1.016	10%	3373	3319	33.7	20569	6.3%	89.5%	3.00%	1.2%	4111	0.71	24.71	0.95	14.60
2021	1.035	7%	3610	3489	36.3	20939	6.8%	89.0%	3.00%	1.2%	4245	0.74	23.81	0.98	13.12
2022	1.053	7%	3862	3667	39.1	21316	7.3%	88.4%	3.00%	1.2%	4387	0.76	22.84	1.02	11.52
2023	1.072	7%	4133	3854	42.1	21700	7.9%	87.9%	3.00%	1.3%	4537	0.79	21.79	1.05	9.78
2024	1.092	7%	4422	4051	45.3	22090	8.5%	87.2%	3.00%	1.3%	4697	0.82	20.64	1.09	7.89
2025	1.111	7%	4731	4258	48.8	22488	9.1%	86.6%	3.00%	1.3%	4866	0.84	19.40	1.13	n/a
2026	1.131	7%	5063	4475	52.6	22893	9.8%	85.8%	3.00%	1.3%	5046	0.88	18.04	1.17	n/a
2027	1.152	7%	5417	4704	56.6	23305	10.6%	85.0%	3.00%	1.4%	5237	0.91	16.55	1.21	n/a
2028	1.172	7%	5796	4944	60.9	23724	11.4%	84.2%	3.00%	1.4%	5441	0.94	14.92	1.26	n/a
2029	1.193	7%	6202	5197	65.6	24151	12.3%	83.3%	3.00%	1.4%	5658	0.98	13.13	1.31	n/a
2030	1.215	7%	6636	5462	70.7	24586	13.2%	82.3%	3.00%	1.4%	5890	1.02	11.17	1.36	n/a

**Figure 8: projection of traffic volume and speed on Dien Bien Phu Avenue with BRT and increasing car traffic**

For instance, in 2016 (line highlighted in the table of *Fig 8*), 4% of the passengers will be using cars against 3% using transit and 92% using motorcycles, but speed on the avenue at peak hour will have decreased from 25.4 km/h to 20.18 km/h. Eventually, in 2025, passengers using cars will represent 9.1% of the passenger flow, while transit will still be 3%, but the flow of vehicles will be at a



standstill at below 7.8km/h. While the passengers using transit will go hopefully faster than the passengers using cars and motorcycles, they will still have much longer trip length than the passengers in 2011 using motorcycle. In 2025 labor and consumers' mobility would have dramatically decreased in Da Nang compared to what it was in 2011!

It appears that under this scenario, car trips are not discouraged but motorcycle are, and it is the motorcycle users who are shifting slowly to transit because of the congestions created by cars.

The design and construction of a BRT network in Da Nang might well be part of the solution to maintain mobility in the future. However, the approach should be how to maintain mobility, i.e. how to create traffic conditions where motorcycle users are safer and do not have significantly slower speed in the future, while part of the trips shift to transit. The solution should not consist in making it impossible for motorcycles to operate in order to boost transit use.

Two important questions should find an answer soon:

- 1) How to price car trips and car parking at their real cost to society?
- 2) How to manage motorcycle traffic in the future to make it safer and as rapid as it is now?

The answers to these questions are beyond the scope of this report but they should be found soon. There might not be many examples in the world of good motorcycle traffic management, but may be excellence and creativity in motorcycle management should be developed specifically for Vietnamese cities. Having roads entirely dedicated to motorcycle use might be a solution. Other roads will have a mix of cars and motorcycles and some roads entirely dedicated to BRT.

#### *Transit routes and housing affordability*

The projected transit routes shown in the transit feasibility study have been established after a careful and thorough analysis of current traffic flows and O&D matrices. They would link the current CBD with the new planned CBD to the West of the city (*Figure 9*). The first phase will serve well the high and middle income areas which are densifying in the north-west part of the city and link them to the old center and the Eastern part of the city. However, most BRT passengers will be obliged to use at least one feeder bus (as indicated in the report) to reach a BRT station and many will have also to use another feeder bus for reach their destination. No BRT could link the residential areas of the poorer part of the population located in the area shaded blue on the map of *Figure 6*, because the main access roads are too narrow (14m) to accommodate 2 BRT lanes and the

existing traffic. Most low income people would have a strong incentive to use their motorcycle.

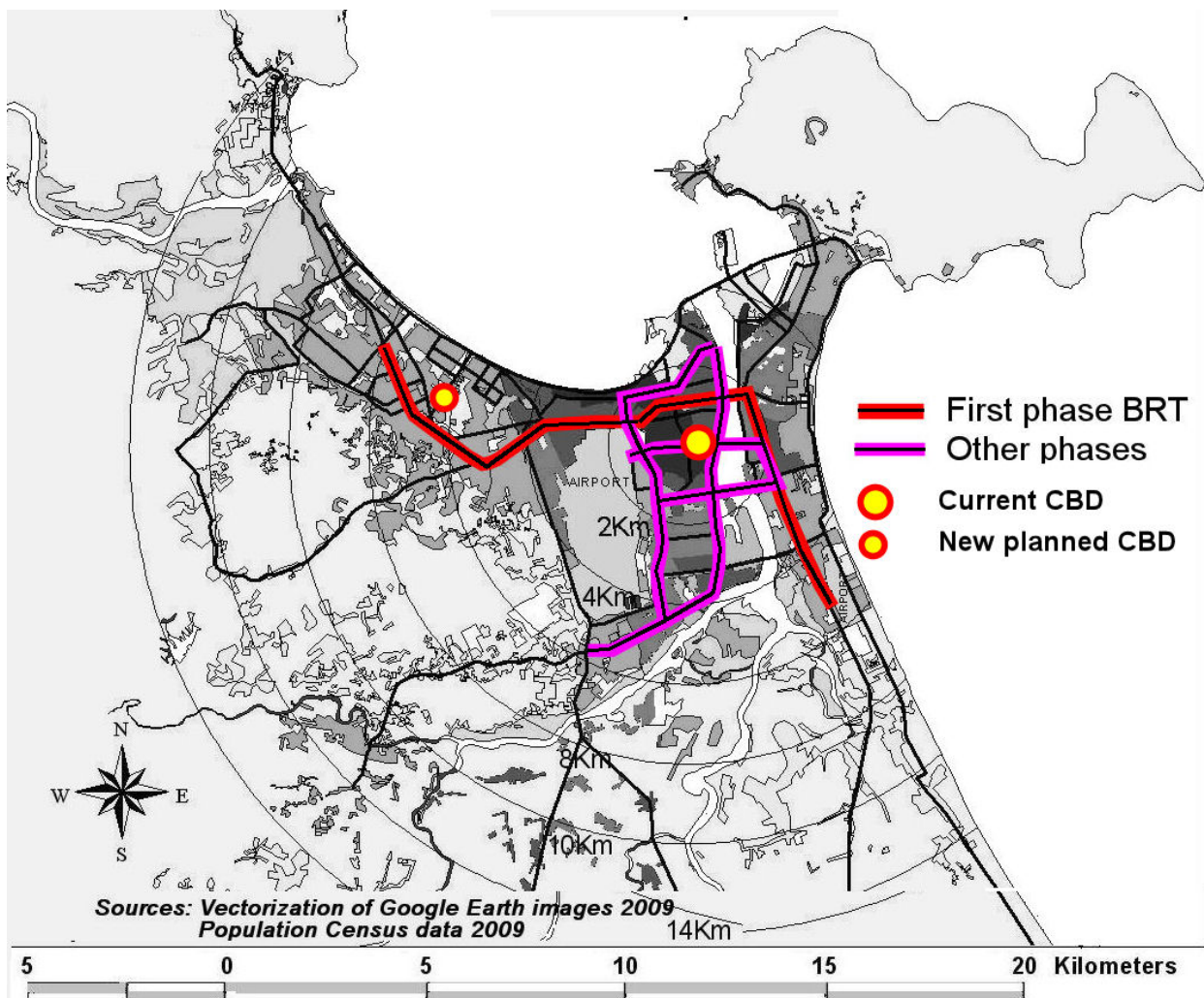


Figure 9: Projected BRT routes

The preceding paragraphs are not a criticism of the assumption made on the need of using BRT in the future in Da Nang, nor a criticism of the BRT feasibility report, which is very thorough and candid about the difficulties of developing a BRT, and its costs and benefits. For instance, the feasibility report insists that using the BRT makes economic sense for users only for trips longer than 15 km for passengers having to use one feeder. As most motorcycle trips are currently shorter than 15 km, this limits the use of BRT and the likelihood that motorcycle users will shift to BRT.

I suggest conducting a thorough study on how to improve the mobility in a city that uses the motorcycle as a major mode of transport. In most Vietnamese cities, because of their density and the small percentage of land used for roads,



BRT and transit in general might or might not be part of the solution, but only part of the solution. Making motorcycle trips safer, and more efficient by designing a road network just for them is certainly also an important part of the solution.

#### 4. Conclusions

Maintaining mobility and housing affordability is the main challenge faced by fast growing Vietnamese cities like Da Nang. The two topics are linked and should be studied together. Land prices and housing income will define affordability but also the likely densities of various neighborhoods and the most effective mode of transport.

In expanding Vietnamese cities, mobility is currently satisfactory thanks to the extensive use of the motorcycle. However, as households income increase there is a fear that individual cars will soon replace motorcycles as a main mean of transportation. For the same number of trips, cars require about 4 times more road space and 5 times more parking space. The high density and low amount of road space of Vietnamese cities are not adapted for cars as a major mean of urban transport. The introduction of mass transit is necessary in the long term but the focus of current policy should be on traffic management taking into account that motorcycle is the main mean of transport and will remain so for the foreseeable future. The objective should be to limit the use of cars by pricing the road space it occupies rather than discouraging motorcycle use hoping that it would increase the use of transit.

The design of transit lines should take into account existing job clusters but also low-income areas. In Da Nang, contrary to Hanoi and HCMC, low-income areas are likely to be segregated in the South West part of the city. Densities in these areas are likely to increase in the future given the heavy land supply constraint imposed by topography. The mobility of the inhabitants of low-income areas will have to be provided by investment in primary roads and eventually by transit networks serving them.

Housing affordability will have to be supplied by a demand driven system, not by government programs that supply every year a number of “affordable” units based on a central plan quota at a price, location and standards based on central plans. Informal settlements, as currently built by low and middle-income Vietnamese households, constitute viable solutions for a demand driven affordable housing supply. The government should support them with a benign regulatory attitude combined with investments in primary roads and social services so that

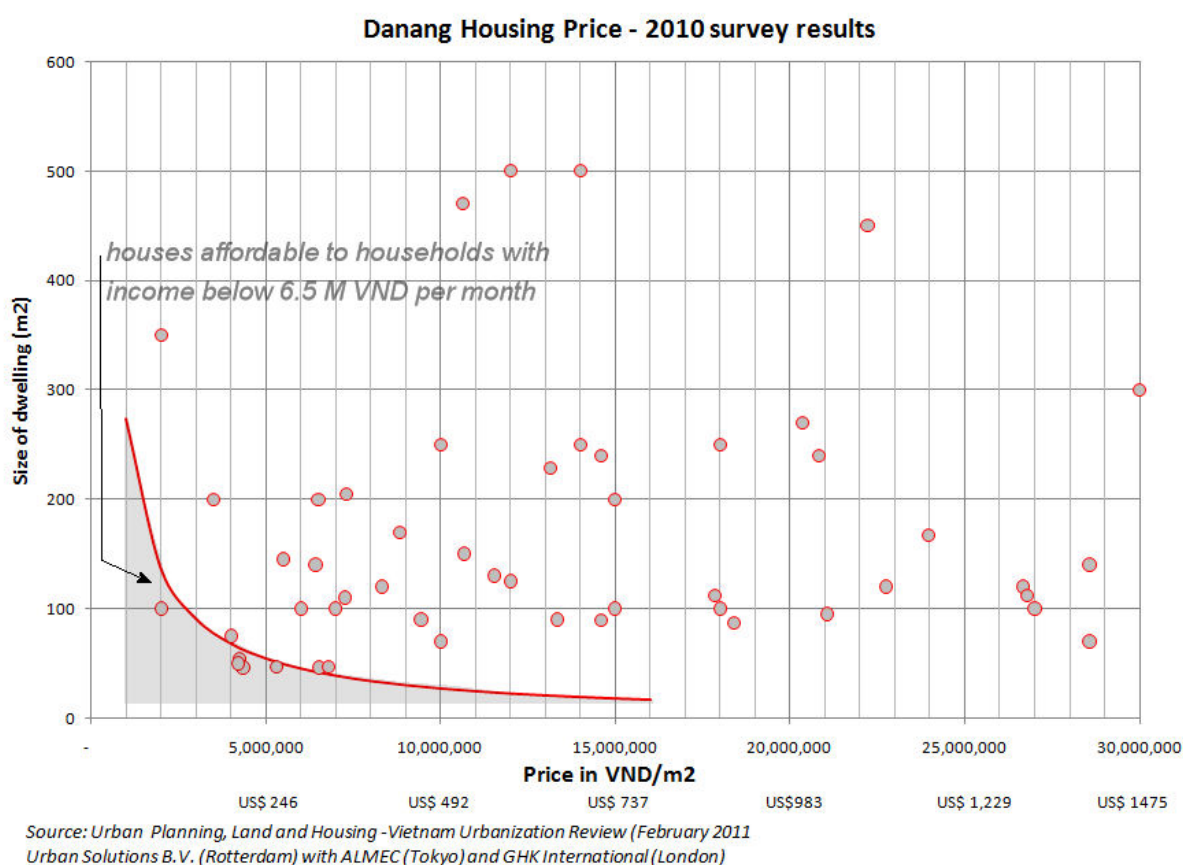
informal roads can be connected to government built road at a distance of not more than about 400 m.



### Annex 1: A comment on Da Nang land and real estate prices survey

The draft report “Urban Planning, Land, and Housing – Vietnam Urbanization Review” prepared by Urban Solutions B.V. ALMEC and GHK, for the World Bank, (February 2011) include a survey of land and real estate prices .

Figure 10 shows the results of the survey relating price per m2 to dwelling floor size (4 outliers have been suppressed for clarity).



**Figure 10: scattergram of surveyed housing in draft report**

We notice immediately the bias of the survey toward high income areas: more than half of the samples have floor area higher than 150 m2 (the survey indicates that the average room size in each low, medium and high income areas varies around 40 m2!). If we represent on the graph the samples that would be affordable to households around the 50<sup>th</sup> percentile (6.5 M VND per month) we find only 4 cases (shaded area on the graph of Figure 10). Obviously a large majority of the households below the 50<sup>th</sup> percentiles are not living on the

sidewalks of Da Nang. It would be important to know where are they living and at what housing standard and which type of housing.

A new price survey should be conducted sampling using a housing typology as a base for stratification. An even better approach would be to create a households income distribution curve and to find what type of housing is currently affordable for households at each decile of the income distribution.

## References

Prud'homme, Rémy & Chang-Woon Lee. 1999. "Size, Sprawl, Speed and the Efficiency of Cities". *Urban Studies*. Vol 36, N° 11, pp. 1849-1858.

"This means that a 10% increase in average speed, all other things constant, leads to a 15-18% increase in the labor market size."

Remy Prud'homme and Chang-Woon Lee found that the productivity of an urban area is a function of the effective size of its labor market, and that a 10% improvement in access to labor (via faster and more reliable work trips) increases productivity, and hence output, by 2.4%