Harvard University - Graduate School of Design
Unit for Housing and Urbanization

CASE STUDY : WHARF THREE

Computer simulation of the development of a large project. The evaluation of any complex project demands an explicit understanding of the linkages and interactions among physical, social and economic variables. The computer simulation model used in this session allows for a independent manipulation of

- development standards;
- capital and operating costs;
- financing terms;
- project phasing; and
- housing policy.

By varying these parameters, the user can assess the ability of a targeted population, whose socioeconomic characteristics have been defined, to be housed in the project.

The development of Wharf Three. A 20 hectare site, Wharf Three, has been selected by the municipal government to house 4,800 households. Formerly used as a shipping related storage and warehousing area, the site is now vacant and belongs to the city which has assigned it a $5 million market value. Its development is viewed as fulfilling two related objectives:

- increasing the stock of available housing; and
- providing the incentive for the revitalization of an area of the city which has been deteriorating as a result of the construction of a container facility further inland.

The project, if financially feasible, may become a model for a broader revitalization strategy.

In accordance with the city's policy to minimize housing subsidies, one third of the units will be sold at their fair market value; another third will be sold to moderate income families and the last third to lower income families, these last two groups benefitting from the state's below market housing financing program. Four housing types are proposed for Wharf Three:

Type A: High density 0- and 1-bedroom units of 70 to 90m^2; construction cost = $130,000.

Type B: High density 2- and 3-bedroom units of 100 to 120m^2; construction cost = $192,500.

Type C: Two- and three- bedrooms walk-up apartments of 120 to 130m^2; construction cost = $156,000.

Type D: Three bedroom row houses of 150m^2; construction cost = $225,000.

You have been asked to evaluate the feasibility of the project. As a first step, you should assign your population to each housing type after determining an appropriate sale price for these units (item 3.2 in the data base) and assigning a value to the land (item 3.4 in the data base). After determining the ability of each income group to acquire housing, you should program the development of the project over the three phases. Note that the length of the phases specified in the data base corresponds to the time required to complete the construction of the project and not necessarily to the marketing of the units.

The model will provide you with a financial analysis for each of three phases. Note that the length of each phase reflects the construction work that has to take place and that few units will be ready to be sold in Phase One.

The cost components estimated by the model consist of:

- Capital costs: Land, off-site infrastructure, on-site infrastructure, community facilities, other project costs.
- Financing costs: long-term financing for both capital investments and the subsidization of housing, if any.
- Recurring costs: operations, maintenance, planning and management.

Revenues consist of:

- Land sales: residential, commercial, industrial.
- Transfer payments for capital costs, and operations and maintenance.
- Fees and taxes levied on the project.
- Capital borrowing.

A projection of future cash flows is provided at the end of each phase. The projection assumes that no more construction would take place. It projects **revenues** consisting of operations and maintenance transfers and real estate taxes. **Costs** consist of recurring expenditures (operations, maintenance, and management) and the amortization of housing and capital costs financing.

The project's benefit:cost ratio, net present value and internal rate of return are also provided at the end of Phase Three, together with a diagram of cash flows.

After determining the extent to which your development strategy is feasible, you should start to modify it to improve its feasibility by varying appropriate parameters in the model.

Project Characteristics

	Phase 1	Phase 2	Phase 3
Project phasing (years)	2	3	2
Area purchased (land area)	20	0	0
Area serviced with primary infrasturcture (land are	20	0	0
Proposed housing subsidy budget (millions)	0	0	0
Land consumption			
Industry (land area)	0	0	0
Commerce (land area / household unit income	0.00000	0.00000	0.00000
Schools (land area / pupil)	0.00000	0.00000	0.00000
Others (land area / household)	0.00000	0.00000	0.00000
Site Development Costs			
Land aquisition (per area of land)	250,000	0	0
Primary infrastructure(/area of land developec	0	0	0
Planned infrastructure budget (millions)	0	0	0
Cost Inflators (% per year)			
Infrastructure		7%	7%
Housing		5%	5%

Population Socio-economic Characteristics

	Household Income		
	Low	Middle	High
Existing Population			
Number of households	0	0	0
Average household size	0.00	0.00	0.00
Average annual household income	0	0	0
Project Population			
Number of households	1,600	1,600	1,600
Average household size	4.10	3.50	2.90
Average annual household income	27,500	55,000	90,000
Housing monthly payment (% of dispoable income	25%	25%	30%
Housing down payment (% of annual income)	40%	70%	100%
Mortgage life (years)	30	30	25
Mortgage interest rate	5.5%	6.5%	7.5%

Housing Characteristics

	Type "A"	Type "B"	Type "C"	Type "D"
Density (land area / dwelling)	0.0008	0.0012	0.0020	0.0100
Cost per dwelling (exclusive of land)	130,000	192,500	156,000	225,000
Secondary infrastructure (/ area of land developec	700,000	700,000	800,000	800,000
Residential land production cost inflators	1.00	1.00	1.00	1.00

Land Improvement Costs

Secondary infrastructure costs	
Industry	0
Commerce	800,000
Community facilities	800,000
Non-residential cost inflators	
Commercial	1.0
Industrial	1.0
Community facilities	1.0
Capital Cost of Community Facilities	
Schools (per pupil)	5,500
Other (per household)	1,000

Project Financing and Management

Intergovernmental Transfers - Capital transfers (% of cost)	
Land aquisition	0%
Infrastructure	0%
Community facilities	100%
Intergovernmental Transfers - Operations and maintenance (% of annual O & M cost)	
Infrastructure	100%
Community facilities	100%
Capital Financing	
Capital costs life of loan	25
Capital costs interest rate	9%
Housing subsidy life of loan	25
Housing subsidy interest rate	9%
Annual project operating costs (% of capital costs)	
Infrasturcture	4%
Community facilities	8%
Planning & Management	6%

Other Indicators

Percent school age population	16%
Net rate of population increase	1%
Annual tax rate (%)	
Residential uses	7.5%
Non-residential uses	15.0%
Amortization period (years)	20
Opportunity cost of capital	10%
Rate of increase of household income	6%