**COS 214 Project Report**

Instructions:

**4.1 Research Brief**

* urban development
* city management principles
* role of various components within a city
  + Buildings
  + Utilities
  + Transport
  + Citizens
  + Government
  + Resources
  + Taxes
  + City Growth
* Reference all sources appropriately.
* Document how these components influenced your design
* Document your
  + assumptions,
  + design decisions, and provide
  + relevant
    - definitions
    - explanations.

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Research Brief

**Urban Development**

Urban development transforms cities to drive economic & social growth. It focuses on improving living standards while addressing environmental concerns that arise from high population density. Key goals include enhancing quality of life through accessible services, housing & efficient transportation. Government, S. (2024)

**Key Principles for City Management**

We used the principles of **Acquiring sufficient funding** (which includes financing running costs, as well as levying taxes) as well as that of **Accountable governance**, as per Nusca, A. (2024). Our government was made to be as efficient and have as positive of an impact on citizens as possible.

ROLE OF VARIOUS COMPONENTS IN THE CITY

### **Buildings**

\*needs new resources!

### **Utilities**

According to the Council of Scientific and Industrial Research (CSIR), residential utilities support domestic needs by providing resources like electricity and materials, while collective services handle waste management and sewer systems. Maintaining these utilities is crucial for citizen satisfaction and efficient public services.

## Transportation

Many factors can influence the method of transport citizens take. These factors include traffic, cost of vehicles & the time taken to travel. This last factor influences citizen satisfaction.Both private and public transportation varies depending on the given scenario. Factors such as traffic, cost of vehicle for public and private ownership and the time of travel influence which method is most efficient to travel across the city. The time taken for travel may impact the citizen satisfaction of the city. Transit, P. (2021)

## Citizens

\*needs new resources!

Government

From our research, the government manages all aspects of the city. Examples are managing **citizen satisfaction and welfare** by ensuring residents have services & adequate housing, as well as **Resource Management**, where local governments are key managers of essential services like water & energy. Hoeflich de Duque, S. (2023)

Resources

Urban areas depend heavily on resources to support their populations and activities. However, rapid urbanisation drives up resource consumption, complicating efforts to uphold sustainability principles. Therefore, effective resource management is essential for achieving sustainable urban development, focusing on maximising resource use while minimising waste and environmental impact. Zucaro, A., Maselli, G. and Ulgiati, S. (2021)

Taxes

Taxes play a key role in how residents feel about their government and their own finances. Changes in tax rates affect people's bank accounts and their satisfaction with public services. There’s often a gap between what citizens want from their local government and what they’re willing to pay in taxes. When people see improvements in services that match their tax dollars, it boosts their overall happiness and financial situation. Glaser, M. A., & Hildreth, W. B. (1999)

City Growth

Population growth significantly impacts taxes by increasing the demand for essential services like housing. As cities expand, they may need to raise tax rates or introduce new taxes to fund these services. Where on the other hand, a larger population can also broaden the tax base, potentially allowing for lower rates. Additionally, as the population grows, disparities in income and living conditions may emerge, prompting local governments to consider progressive tax structures to address these inequities.

Bahl, R., Holland, D. & Linn, J., (2015)

Components influence on design

Utilities

As per the team’s research, a heavy dependency concerning building and citizen satisfaction was placed upon our collective services (waste and sewage management) as well as residential utilities (such as the construction of materials needed for building, electricity and water management).

The role of the Utilities section within our system is to ensure that when a request is made to start creating a new building object, a call is made to construct the needed resources through the use of the Utilities interface, allowing its interaction with the Government as well as the Resource classes. It will ensure that sufficient resources are available to be used by Building objects by calling for the construction of new materials when a new property is made. Additionally, the Utilities (specifically public collective services: sewerage and waste management) will play a role on the satisfaction of the city, allowing for the user to determine if there is an efficient management of these public utilities on the city.

Transportation

1. **Influence on the design**

The reason why a template-like design was implemented within this section is because the interface will defer some steps and variables off to its subclasses (the various modes of transport) which are overridden based on the citizen’s choice of transport.

1. **The role of the component within our system**

The transportation component is used within our system to influence factors such as citizen satisfaction, impact from a given scenario (car accident) and the generation of income from public modes of transport (impact on Bank and Government). The transportation section therefore has an economic, functional and qualitative role based on the effective management of the city.

Design Patterns

I asked Brendan today (31 Oct) what patterns we used and where:

Composite, Iterator → Buildings

Factory Method, Prototype → Citizens

Mediator → Government

Template Method → Transport, City Growth

Strategy → Taxes

State → Resources

Chain of Responsibility → Utilities

Command → Scenarios

\*highlighted are the 4 from the required advanced (after chapter 12) patterns

10 in total

# References

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* Bahl, R., Holland, D. & Linn, J., (2015). *Urban growth and local taxes in less developed countries*. Available at:<https://scholarspace.manoa.hawaii.edu/server/api/core/bitstreams/4b852e95-4d3b-4c3c-a9ba-e166f883d452/content> [Accessed 29 Oct. 2024]

Design Pattern Application Report

4.2 Design Pattern Application Report

* Detail how each of the chosen design patterns has been applied to address specific functionalities within the system.

Chosen design patterns:

* Augment explanations with relevant UML diagrams to illustrate the implementation of design patterns. This is not limited to UML class diagrams.