**THE MULTIFAMILY REAL ESTATE DEVELOPMENT PROCESS:**

**AN OPTIMIZATION APPROACH TO DEVELOPMENT EVALUATION**

Zain Sayed, Melek Mizher, Spencer Puterbaugh, Rohan Tandon

Northwestern University

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**Abstract**

Insights into a land parcel’s development and density potential using an optimization framework based on characteristics of recently developed and under-construction properties can be an effective prescreening tool for multifamily real estate developers to evaluate land sites. Using an example land parcel in Austin, TX, results show that an optimization model can provide valuable information on the number of units with a high likelihood of approval before engaging in a detailed and costly feasibility analysis.

**Keywords:** Optimization, Investment Decision Analysis, Multifamily Investment, Commercial Real Estate, Investor Opinion

1. **Introduction**

One of the most important fundamental questions that multifamily real estate developers face is determining the feasibility of a land site for future development. While multiple factors go into a feasibility analysis, one of the most significant uncertainties is whether a community’s city council and/or planning board will approve a site for development and at what density (i.e. the number of units). To mitigate these uncertainties, real estate developers devote significant time and resources utilizing land use attorneys and architects to provide an initial analysis of the density of a particular land site and the city council and/or planning board’s inclination to approve a development. Often, the results of this analysis do not prove fruitful, leading developers to have sunk costs.

Optimization insights into a site’s density and approval potential can be an effective tool for multifamily developers to evaluate sites en-mass and avoid sunk costs. This paper proposes an optimization framework to determine an approvable unit density based on characteristics of recently developed and under-construction properties near an example land parcel located at 11200 Lakeline Blvd. in Austin, TX. Overall, the optimization framework has the potential to provide multifamily developers with an effective prescreening tool as part of the development process.

1. **Literature Review**

Research regarding optimization modeling techniques within the context of real estate development is very limited as environments, requirements, regulations, and other specific details vary greatly between regions and oftentimes within them as well. Therefore, a lot of the processes for designating approvals have been analog. The City of Austin follows a flowchart for the approval process for land development based on City Ordinance § 25-4-1 which designates subdivision compliance requirements. These requirements include a Development Assessment to ensure proper land use zoning. Zoning review follows as the impacts of the development based on City Ordinance § 25-5-1 which designates the Land Use Commission’s review process for Land Development compliance. This process includes environmental, parking, traffic, forestry, zoning, utility, lot design, and drainage impact reviews. Sharma, Al-Hussein, and AbouRizk (2006) explored lot grading approval optimization in Edmonton, Canada. Their objective was to speed up the approval process as a low number of inspectors was a bottleneck for development projects, leading to increased costs. This process used a simulation that allowed an increased number of inspections and a higher grading approval rate. Damodaram and Zechman (2013) explored the effect and optimization of urbanizing watersheds by focusing on a watershed on the Texas A&M University Campus. Impervious surface data from 62 rooftops, 65 parking areas, and storm drainage infrastructure, including rooftop rainwater harvesting systems, were used to understand the effects of impervious surface areas on the parcel’s water flow and retention ponds. Each of the papers mentioned provides insights into optimization frameworks for real estate applications.

1. **Methods**

The objective is to develop a framework that will aid multifamily real estate developers in determining an optimal number of units that can be built upon a particular parcel of land and has a higher probability of being approved by a community’s city council and/or planning board. Data for this project was obtained from the City of Austin’s Building + Connect public search database. The database contains development information and approved site plans for developments across the City of Austin. The database was used to extract information on developments completed or under construction within the past two years. Furthermore, the data was filtered to include only developments within a five-mile radius of the subject parcel of land to ensure comparability.

The developed framework incorporates features and their associated values from previously approved development plans as constraints in a linear programming model that outputs the maximum number of units with a high likelihood of being approved for construction. Features used for the constraints included the number of units, land acreage, impervious coverage percentage, building coverage percentage, open space percentage, parking ratio, and floor-to-area ratio. The objective function is weighted by the importance of the features determined by a random forest regressor. Additionally, descriptive statistics of the source data set were used to construct the boundaries of the constraints in the linear programming model, forming guidelines within which the model could generate its conclusions.

1. **Results**

Based on the linear programming model developed for this project, the optimal number of units with the highest likelihood of being approved by the City of Austin is 295. This model takes into account the features of the development plan that are the most important, particularly the height of the development and the parking ratio when generating its output. As the real estate development landscape shifts, and the members of the Austin City Council change, this model will be able to account for changes and adapt to provide guidance when creating development plans.

1. **Conclusion**

Optimization insights into a site’s density and approval potential can be an effective tool for multifamily developers to evaluate sites en-mass and avoid sunk costs. The optimization framework using feature information from surrounding developments can indicate that a certain unit density can be approved by a community’s city council and/or planning board. The insights gained regarding feature importance are crucial to make this study transferable to other parcels and geographical regions. Different regulations provide for different feature importance values across jurisdictions. This tool can serve as a proxy for an initial real estate feasibility analysis that can generate an efficient solution for a multi-family developer, reassuring investors regarding development approval timelines and accurate predevelopment costs of a project.

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