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Article

# Accessory Dwelling Units as a Policy Execution Challenge: Feasibility, Regulatory Risk, and Early-Stage Decision Modeling

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**Abstract:** The United States faces a structural housing shortage estimated at 3.8 million units, and accessory dwelling units (ADUs) have emerged as a key policy instrument to expand housing supply within existing residential neighborhoods. Despite broad legislative support-including California's SB 9 and SB 10, and federal incentives under HUD's ADU pilot programs-actual ADU construction rates remain far below policy targets. This paper argues that the primary barrier is not construction capacity or design expertise, but rather uncertainty in early-stage feasibility determination. This study proposes a methodological framework for pre-design feasibility analysis that integrates parcel-level conditions, zoning parameters, regulatory constraints, and procedural requirements to identify viable development pathways and quantify regulatory risk prior to architectural engagement. By shifting feasibility assessment upstream in the development lifecycle, the approach reduces reliance on trial-and-error permitting, improves decision clarity for property owners, and lowers administrative burdens for local planning and building departments. A simplified case application using a prototypical Los Angeles parcel demonstrates the framework's practical utility. The proposed methodology positions early feasibility analysis as a foundational decision infrastructure supporting more consistent, scalable, and equitable housing policy execution across U.S. jurisdictions.

**Keywords:** Early feasibility analysis; Regulatory risks; ADU policy; Housing supply; Decision modeling; Zoning Compliance

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## 1. Introduction

When feasibility is ambiguous at the outset, projects frequently stall mid-process due to zoning conflicts, setback violations, or coverage limit exceedances discovered only after significant investment [1]. The result is a compounding cycle of wasted resources, deferred housing units, and eroded homeowner confidence in the permitting process [2]. This paper addresses that structural gap by proposing a methodological framework for pre-design ADU feasibility analysis. The framework integrates parcel-level spatial conditions, municipal zoning parameters, building code constraints, and procedural regulatory requirements into a unified early-screening model [3]. By resolving compliance uncertainty before the design stage, the framework aims to improve housing production outcomes, reduce administrative friction for planning departments, and support more equitable distribution of ADU development across income levels and geographies.

## 2. Policy Context and Implementation Constraints for ADU Development in the United States

In recent years, ADU has been regarded as an important solution to address the housing shortage issue and has continuously received policy support at the federal, state and local levels in the United States. States such as California, Oregon and Washington have successively implemented reforms for simplifying approvals and local preemption. Many cities have also allowed the construction of ADU in most residential areas in accordance with the law [4]. However, Legislative authorization has not automatically translated into proportional increases in ADU production. Detached, attached, and converted ADUs face different regulatory requirements related to setbacks, lot coverage, fire separation, and habitability. Because these regulations vary by jurisdiction, depend on site-specific conditions, and interact cumulatively, property owners often find it difficult to accurately assess project feasibility at the initial stage [5].

Figure 1 illustrates the primary ADU typologies encountered across U.S. residential jurisdictions: detached ADUs, attached ADUs, conversion ADUs, and multiple ADUs. Each typology is associated with distinct regulatory requirements related to setbacks, lot coverage, fire separation, and habitability, which further complicates early-stage feasibility determination.

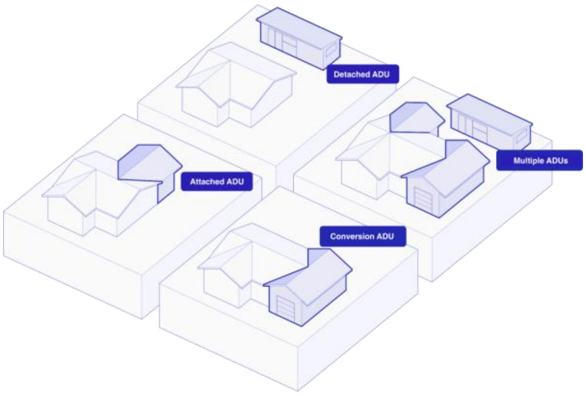

**Figure 1.** Primary ADU Typologies in U.S. Residential Development.

Figure 1 illustrates the primary ADU typologies encountered across U.S. residential jurisdictions, including detached, attached, conversion, and multiple ADUs. Each typology is associated with distinct regulatory requirements related to setbacks, lot coverage, fire separation, and habitability, which complicates early-stage feasibility determination.

To further identify the specific occurrence points of the aforementioned regulatory conflicts during the project implementation process, Figure 2 illustrates the general approval process for ADU development, as well as the review stages where additional requirements and scheme adjustments typically come into play.

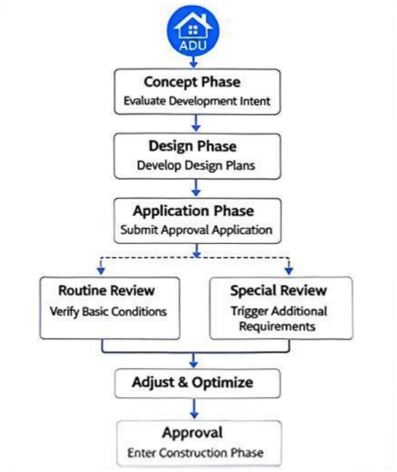

**Figure 2.** ADU Development Approval Process

The regulatory parameters governing ADU development span multiple overlapping domains. Table 1 organizes the primary constraint categories encountered across U.S. jurisdictions, drawing on zoning codes from California, Oregon, and Washington as representative examples.

**Table 1.** Main Regulatory Factors Involved in ADU Development

| Control Category | Key Parameters | Main Impact |
|---|---|---|
| Parcel Conditions | Lot area, lot width, existing building layout | Determine buildable space and ADU layout |
| Planning Control | Zoning district, setback requirements, coverage limits | Constrain building location and development intensity |
| Building Codes | Building height, fire separation distance, minimum residential area | Affect building form and spatial scale |
| Approval Procedures | Administrative approval, planning review, permit procedures | Determine project approval pathway and implementation timeline |

## 3. Early Feasibility Analysis Method Framework for ADU

### *3.1. Technical Process of Early Feasibility Analysis*

Traditional ADU projects usually enter the feasibility assessment stage only after the design scheme is completed. This results in problems that do not meet planning requirements often being exposed only during the approval process, which then leads to scheme rework, increased costs, and extended project duration [6]. To improve the efficiency of early decision-making, the feasibility analysis can be conducted before the design starts, using the basic data of the plot as input. It sequentially checks constraints such as setback, building coverage rate, building area, height control, and approval conditions, and based on this, identifies the feasible paths for detached, attached, or renovated ADUs [7]. This analysis does not replace the formal design and approval process; instead, it serves as a screening mechanism for the early stage.

Figure 3 presents the proposed technical workflow for early feasibility analysis, illustrating the sequential constraint-checking logic from parcel data input through development pathway identification.

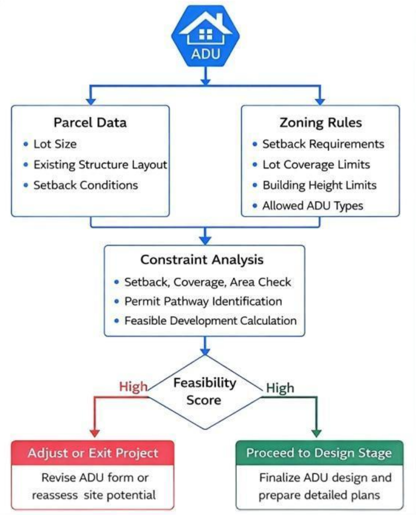

**Figure 3.** Early Feasibility Analysis Process of ADU.

Formally, the overall feasibility index F is expressed as a weighted composite of individual constraint satisfaction scores, adjusted for spatial utilization efficiency. Let $C_i$ represent the degree of satisfaction of the i-th planning or building code constraint (where 1 indicates full compliance and 0 indicates non-compliance), and let $w_i$ be the normalized weight assigned to that constraint based on its regulatory significance. The composite feasibility index is then expressed as:

$$F = \sum_{i=1}^{n} w_i \cdot C_i \cdot \left(\frac{A_{buildable}}{A_{lot}}\right)^{\alpha} \qquad (1)$$

Among them, F represents the comprehensive feasibility index of the project; $C_i$ represents the satisfaction degree of the i-th constraint condition, with a value range of 0 to 1; $w_i$ represents the standardized weight of the corresponding constraint condition, and it satisfies $\sum w_i = 1$. $A_{buildable}$ is the buildable area after deducting restrictions such as boundary retreat, and Alot is the total area of the plot. $\alpha$ is the spatial utilization adjustment coefficient. This ratio is used to reflect the impact of the remaining buildable space on the feasibility of the project. In the baseline application of this article, $\alpha$ is set to 1.0, indicating a linear relationship between space utilization and feasibility. This value is used as a demonstrative initial simplified setting, and can be adjusted later based on specific standards or empirical results of different jurisdictions. Thus, this formula integrates the compliance evaluation of constraints and the spatial carrying capacity into a unified framework: even if the compliance degree is high, if there is insufficient buildable space, the overall feasibility score will still decrease accordingly. When F reaches the preset threshold, it can be considered that the project has met the basic conditions for entering the design stage.

### *3.2. Parcel Conditions and Zoning Control Parameters*

Parcel conditions and zoning control parameters together define the feasible development envelope for any ADU project. The plot area, width, location of existing buildings, and setback requirements jointly affect the scope of the constructible space; planning indicators such as building coverage rate, building area, height limit, and permitted construction types further constrain the scale and form of development [8]. During the feasibility analysis stage, the basic information of the plot and the planning parameters can be integrated into a unified parameter set to provide a basis for subsequent constraint verification and development path judgment. Table 2 summarizes the main plot and planning parameters involved in the feasibility analysis.

**Table 2.** Parcel Conditions and Planning Control Parameters

| Parameter Category | Key Variables | Main Function |
|---|---|---|
| Parcel Size | Lot area, lot width | Determine the scale of buildable space |
| Setback Control | Front setback, side setback, rear setback | Limit the range of building placement |
| Development Intensity | Building coverage ratio, building area | Control construction scale |
| Building Restrictions | Building height, ADU type | Affect building form |

A key derived metric in the parcel analysis is the potential development coefficient P, which estimates whether the residual buildable area-after accounting for setback zones and existing building footprints-is sufficient to accommodate a minimum-compliant ADU. The expression is:

$$P = \frac{(A_{lot} - A_{setback} - A_{existing}) \cdot R_{coverage} \cdot R_{height}}{A_{adu,min}} \qquad (2)$$

Among them, $A_{lot}$ represents the total area of the plot, $A_{setback}$ indicates the area that cannot be built due to boundary retreat requirements, $A_{existing}$ represents the area occupied by existing buildings, $R_{coverage}$ is the applicable building coverage control value, $R_{height}$ is the height control correction coefficient, and $A_{adu,min}$ is the minimum ADU building area that meets basic usage requirements. P is used to measure whether the remaining construction space under the existing plot conditions is sufficient to support ADU development; when $P \geq 1$, it can be considered that the plot has basic construction conditions, while when $P < 1$, the parcel is unlikely to support new ADU construction under current conditions, and alternative development pathways, such as conversion ADUs, should be further evaluated.

### *3.3. Identification of Regulatory Risks and Analysis of Compliance Paths*

The regulatory risks in the development of ADU mainly stem from differences in the interpretation of planning provisions, uncertainty in the approval process, and additional reviews triggered by specific plots or design conditions. When a project meets objective control standards, it can typically proceed through a more clearly defined administrative approval process; however, when it involves special restrictions, coverage thresholds, irregular plots, or additional review requirements, the risk of approval and the uncertainty of the process will significantly increase [9]. Therefore, in the early feasibility analysis, it is necessary to identify the approval paths that the project may enter and conduct a quantitative assessment of the regulatory risks associated with them.

The regulatory risk index R aggregates the risk contributions of individual constraint conditions, weighted by their procedural significance and scaled by the ratio of the proposed ADU area to the applicable regulatory ceiling. It is expressed as:

$$R = \sum_{i=1}^{n} \lambda_i \cdot (1 - S_i) \cdot \left(\frac{A_{adu}}{A_{limit}}\right)^{\beta} \qquad (3)$$

Among them, $\lambda_i$ represents the risk weight of the i-th regulatory condition, $S_i$ indicates whether the condition is met, $A_{adu}$ is the proposed area of the ADU, $A_{limit}$ is the upper limit of the area permitted by regulations, and $\beta$ is the scale-sensitive coefficient. In this formula, only the unmet conditions will have an impact on the risk value; moreover, the closer the proposed area is to the control limit, the higher the approval uncertainty faced by the project usually is. The larger the R value is, the more likely the project is to require adjusting the plan or choosing a different implementation path.

### *3.4. Construction of Early-Stage Decision Model*

After completing the analysis of the site conditions, verification of planning constraints and assessment of regulatory risks, the relevant results can be further integrated into a project decision model. This model takes spatial conditions, planning control parameters and regulatory risks as inputs, and makes a comprehensive judgment on the feasibility of the proposed ADU scheme to proceed to the next stage, thereby providing a basis for project advancement, adjustment or path transformation.

The project decision index D is used to comprehensively reflect the impact of site conditions, the satisfaction of planning constraints and regulatory risks on the project's advancement capability, and its expression is as follows:

$$D = \frac{\sum_{i=1}^{n}(w_i \cdot C_i) + \gamma \cdot \left(\frac{A_{buildable}}{A_{adu}}\right) - \delta \cdot R}{1 + lnln(1+n)} \qquad (4)$$

Among them, $w_i$ and $C_i$ represent the weights and satisfaction degrees of each constraint, $A_{buildable}$ represents the buildable area, $A_{adu}$ represents the proposed ADU area, R is the regulatory risk index, $\gamma$ is the spatial adaptation coefficient, $\delta$ is the risk reduction coefficient, and n is the number of constraint conditions included in the calculation. D is used to measure the overall preparedness of the project for entering the design and approval stage. The higher the value, the more mature the project implementation conditions.

## 4. Application and Implementation Path

### *4.1. Application Mechanism of Feasibility Analysis Process*

This feasibility analysis framework is mainly used during the initial stage of project initiation, before the formal design and approval [10]. It is used to predict potential ADU schemes. After the project is initiated, based on publicly available land area, existing building distribution, zoning regulations, setback requirements, and state-level policy parameters, a basic data set required for the preliminary analysis can be constructed, and the feasibility index, potential development coefficient, regulatory risk index, and decision index can be calculated successively. Through a comprehensive assessment of spatial conditions, planning constraints, and approval risks, the framework can provide suggestions for project advancement, scheme adjustment, or development path transformation, thereby providing a pre-decision basis for the owner and the design team. This method does not replace the formal design and approval process; instead, it serves as a screening mechanism before entering the subsequent process to improve information integrity and reduce subsequent revisions [11]. Figure 4 shows the specific application path of this framework in the project development process.

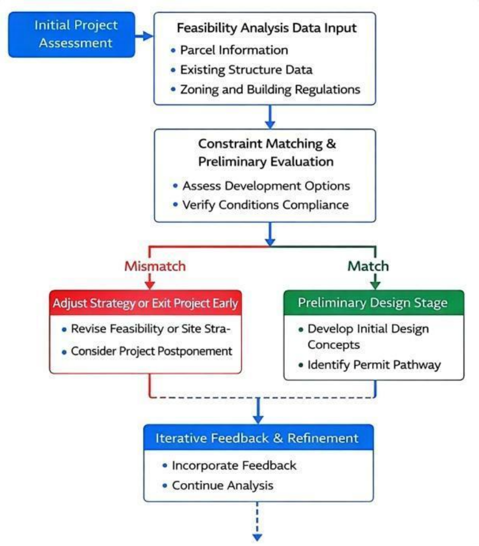

**Figure 4.** Application Process of Early Feasibility Analysis Method.

### *4.2. Identification of Development Paths under Different Land Parcel Conditions*

The site conditions are the key factors influencing the selection of ADU development types. To illustrate how this framework generates differentiated development paths, this article analyzes different site scenarios by combining the typical site characteristics of the R1 single-family residential zoning in Los Angeles. For larger sites with a low proportion of existing buildings, standalone ADUs usually have higher feasibility; medium-sized sites are more likely to be suitable for attached or garage-revamped ADUs; while smaller sites or those with higher development intensity are more suitable for implementing renovated ADUs within existing buildings.

This typology-based classification represents a core feature of the framework's practical utility. It does not simply provide a "feasible/unfeasible" conclusion, but identifies a more suitable compliant development path based on site conditions, thereby enhancing the targeted nature of the initial decision-making. For sites with limited space, this method is particularly helpful in uncovering the potential capacity of renovated ADUs and promoting more extensive and more balanced ADU development [12].

### *4.3. Decision Support under Regulatory Constraints*

The regulatory constraints in the ADU development process are not uniform. Different regions, land plot conditions, and project characteristics will affect the selection of the approval path, and further influence the project cycle and implementation certainty. When a project meets the objective control standards, it can usually enter a relatively clear administrative approval procedure; however, once it involves special locations, irregular land plots, or additional review requirements, the project may enter an approval path with greater uncertainty, resulting in increased time costs and adjustment risks [13].

In response to this difference, this article framework incorporates the identification of approval paths into the regulatory risk assessment process. When the degree of compliance with the constraints is high, the project can be classified as low-risk and proceed along the regular approval path; when some conditions are close to the control boundaries or are not met, the system will identify potential risk sources and alert the key factors that need to be adjusted, thereby providing a basis for the optimization of the initial plan and the selection of the approval path [14].

To support pathway classification, a simplified decision support index S is defined as a ratio of weighted constraint satisfaction to risk-adjusted regulatory exposure:

$$S = \frac{\sum_{i=1}^{n} \theta_i \cdot C_i}{1+\mu \cdot R} \tag{5}$$

Among them, $\theta_i$ represents the weight of each planning constraint, $C_i$ represents the degree of constraint satisfaction, R represents the regulatory risk index, and μ represents the risk sensitivity coefficient. S is used to comprehensively reflect the influence of planning constraints and regulatory risks on the project decision-making support; when the constraint satisfaction degree is high and the regulatory risk is low, the value of S increases accordingly, indicating that the project has more conditions for entering the next stage; when there are unresolved constraint issues, the value of S will decrease, suggesting that further adjustments to the plan or re-evaluation of the development path are needed. This indicator can be calculated based on public planning data and is applicable for early screening and digital decision support.

## 5. Conclusion

This paper focuses on the issue of "enhanced policy support but insufficient actual output" in the development of ADUs in the United States, and proposes a feasibility analysis framework for the early stage of the project. This framework integrates site conditions, planning parameters and regulatory risks to quantitatively assess the implementation conditions of the project before design, and identifies suitable development paths such as detached, attached and renovated types. Research shows that the pre-screening helps reduce later approval conflicts and scheme revisions, and improves the efficiency of project decision-making. This method can also be connected with the GIS site database and digital approval platform to provide technical support for the promotion of ADUs and the improvement of housing supply.

The framework proposed in this paper is currently mainly verified based on the prototype plot under the R1 zoning condition in Los Angeles. Its applicability in different states, cities, and under different zoning rules still needs further testing. Especially in areas with a higher degree of local autonomy and significant differences in approval paths, the weights of relevant indicators and the threshold values may need to be recalibrated in combination with actual licensing data. Future research can introduce cross-regional cases on a larger scale to empirically correct the model parameters and test its explanatory ability for approval results and implementation efficiency. The output results of the framework, such as the constructible boundaries, type determination, and path identification, can also serve as the basis for subsequent integration into GIS approval platforms, prefabricated component libraries, and standardized design systems.

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