

# Final Analysis and Findings

## 1. Socioeconomic Community Structure (Similarity Network + Louvain Clustering)

Our first objective was to understand whether Forest Glen's block groups exhibit internal cohesion from a socioeconomic perspective. To do this, we built a socioeconomic similarity network using ACS 2020 block-group variables such as median income, age, educational attainment, and housing tenure. Each block group was represented as a high-dimensional feature vector and normalized to remove scale effects. Pairwise similarities were computed using inverse Euclidean distance and converted into a weighted adjacency matrix.

Applying the Louvain community detection algorithm revealed **five distinct socioeconomic clusters** within Forest Glen. The map clearly shows spatially coherent regions, where adjacent block groups share similar income levels, education patterns, and housing dynamics. These clusters strongly align with known neighborhood sub-areas such as Sauganash, Edgebrook, and Forest Glen proper. Overall, this analysis validates that Forest Glen is indeed a structured community rather than a random grouping of census areas.

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## 2. Mobility-Based Community Structure

Next, we examined how residents *move*—their commuting behaviors, travel times, and reliance on different transportation modes. Using ACS commuting variables (drive-alone, public transit, walking, long commute share), we constructed a mobility feature matrix and performed Louvain clustering on the resulting similarity graph.

Five mobility clusters emerged and revealed a completely different type of structure:

- Some block groups showed **high automobile dependency** and very low transit/walking rates.
- Others exhibited **elevated transit usage or higher rates of long commute times**, suggesting connectivity to distant employment hubs.
- A few groups formed a smaller cluster centered around **moderate walking rates and mixed commute patterns**.

Spatially, these mobility clusters do not always align with socioeconomic groups. Certain high-income areas cluster together socially but diverge in mobility due to differences in car-ownership or commute distance. This demonstrates how mobility adds a meaningful second dimension to understanding neighborhood structure.

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## 3. Multilayer (Socioeconomic + Mobility) Similarity Network

To integrate both dimensions, we created a combined multilayer similarity network using a weighted combination of socioeconomic similarity and mobility similarity. The resulting

network embeds each block group in a dual-feature space and detects communities that are consistent across both layers.

The multilayer Louvain clustering produced **two major, stable clusters** across Forest Glen. This result is striking because both underlying networks separately produced many clusters, but when fused, the neighborhood organizes into only two robust community groups. This implies that while socioeconomic and mobility patterns vary internally, Forest Glen's block groups ultimately gravitate toward two overarching identities:

1. **Cluster 1:** Higher stability in socioeconomic characteristics (higher education, higher income, owner-occupied housing), coupled with shorter commutes and predominantly car-based travel.
2. **Cluster 2:** Moderately mixed socioeconomic areas with higher transit usage, longer commute times, and more diverse mobility patterns.

This fused view provides stronger evidence that Forest Glen functions as a coherent community, but with two distinct sub-structures that influence daily life and accessibility.

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## 4. Key Insights and Overall Interpretation

Across all layers of analysis, a clear picture emerges:

- **Forest Glen is moderately cohesive**, but internal variation exists along both demographic and transportation lines.
- **Socioeconomic patterns form more nuanced sub-clusters**, reflecting long-standing differences in wealth, housing, and education.
- **Mobility patterns cut across socioeconomic boundaries**, showing that commute behavior is strongly influenced by geography (e.g., proximity to Metra, main roads) rather than just demographics.
- **The multilayer network reveals the most stable structure**, identifying two meaningful community identities that jointly capture both social and mobility characteristics.

This multi-dimensional approach moves beyond a simple demographic or geographic analysis and instead captures how people *live* and *move* within Forest Glen.

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## 5. Future Work and Extensions

Several directions can deepen this analysis:

- Incorporating **green space accessibility, safety data, or housing market trends** to enrich the socioeconomic layer.
- Adding **CTA/Metra network connectivity or real-time travel-time data** to enhance the mobility layer.
- Building a **temporal multilayer model** comparing 2010–2020 changes in both mobility and socioeconomic similarity.

