Impacts on the Transportation Network Generated by New Employment at the Proposed Disconnected Semiconductors Facility

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Executive Summary

The introduction of a new plant for Disconnected Semiconductors in the Northridge neighborhood is expected to lead to localized traffic impacts throughout the twin cities region, as the region's workforce increases by 5%. The following study was commissioned to estimate the increased stress on the region's existing transportation network, and determine possible mitigation strategies to decrease the traffic burden associated with the added employment.

Without mitigation efforts in place, the introduction of Disconnected Semiconductors and the associated employment will add an annual travel cost of $2,459,507 to the local transportation network. Three different scenarios were analyzed, which can reduce the annual travel cost through infrastructural and programming investments. The lowest annual cost achieved by a mitigation strategy totals $1,723,008.

Disconnected Semiconductors is expected to be a positive financial benefit to the region if the increased travel costs can be offset with new economic benefits of $287/year per employee, including auxiliary workers not directly employed by the factory.

- In the event of this new employment, the most favorable option would be to expand North Bridge. However, this does require an up-front cost of $20,000,000, which may be difficult to finance over the 30-year period analyzed.
- As a value proposition, the Transportation Demand Management (TDM) strategy is a more cost-effective approach, producing a much higher benefit over the implementation cost.
- In conjunction, both the new bridge and the TDM program produce the highest annual benefit, though the TDM program has a significantly smaller positive benefit ratio after bridge expansion.

Assuming the area's economic benefit from Disconnected Semiconductors exceeds the cost to the transportation network, it is advised to pursue an expansion of North Bridge with a coordinated completion date. Simultaneously developing a TDM program for the Northridge area is also advised, though is considered a lower priority unless options for bridge expansion financing are unable to be found.

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Introduction

This study has been conducted to understand the impact of Disconnected Semiconductors' impact on the transportation network, following the direct employment of 2,000 new residents, and a corresponding induced increase in local non-basic employment.

The primary question of the study was the cost of increased congestion on the region's two bridges, which are already experiencing a small amount of congestion prior to the new workforce at the plant and the induced local non-basic workforce increases.

Two mitigation strategies have been suggested for analysis: an expansion of the North Bridge to accommodate a 75% increase in traffic volume, and a transportation Demand Management (TDM) program to increase peak-period carpooling to the Northridge industrial employment centers.

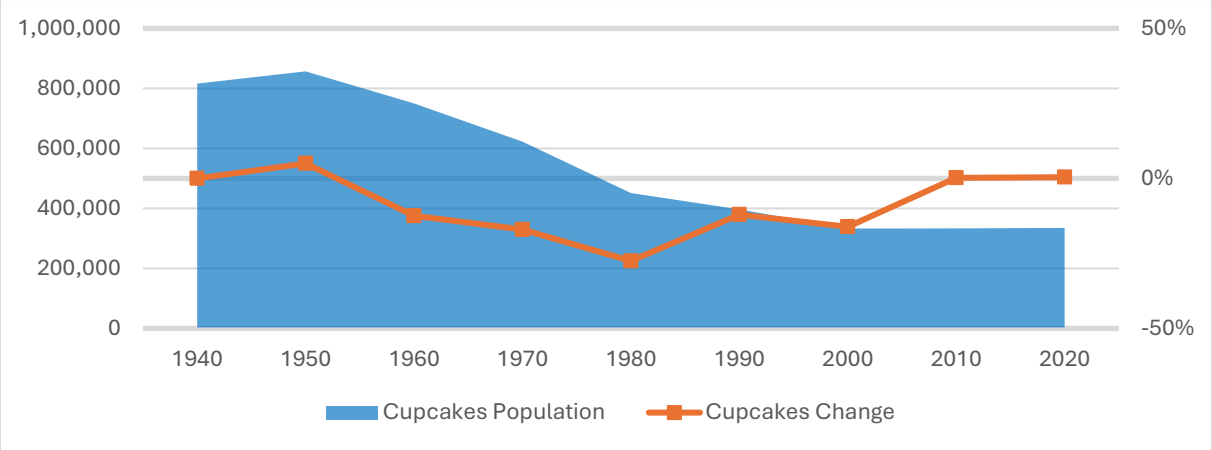
These mitigation strategies are analyzed over a 30-year period, separately and in conjunction, in order to determine the best benefit-cost ratio for mitigating the traffic impact of the new employment resulting from the plant's opening.

Background

Population Trends

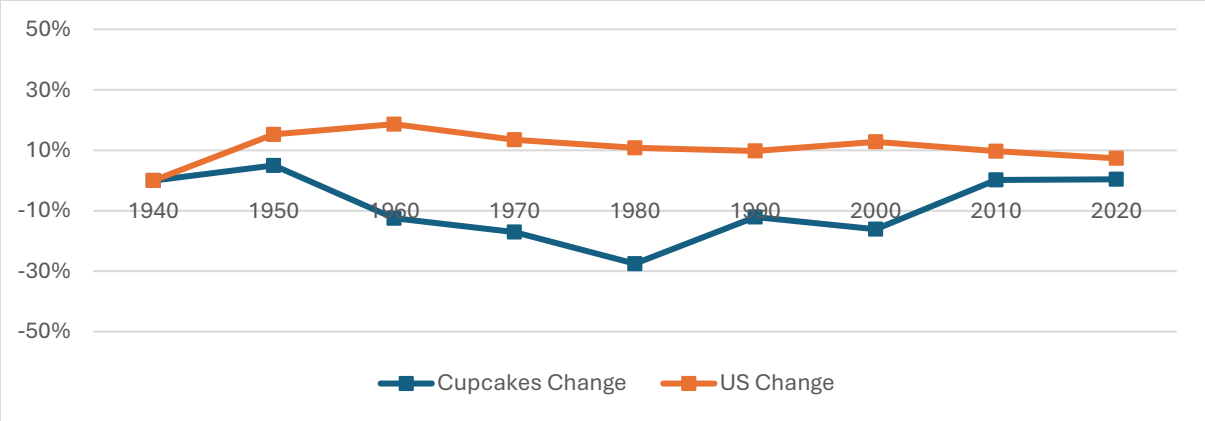
The region has experienced significant population loss since its 1950 peak, with the region currently at approximately a third of its peak population. Population loss has leveled off for the past two decades, however, with a relatively stable local population since 2000.

Table 1 - Change in regional population, 1940-2020.



The largest population decline occurred in 1980, though decline had been well underway before this era of deregulation and globalization. This diverged from national population growth over the same period.

Table 2 - Comparison of regional and national population change, 1940-2020.



Regional Employment

As a historic rustbelt region, a significant share of the regional employment is concentrated in the manufacturing and transportation/warehousing sectors. Approximately 23.4% of regional employees are currently employed in the manufacturing sector, the largest employment sector in the region. This indicates that while historic population loss was due to a reduction in local manufacturing jobs, the region is still an industrial exporter.

Table 3 - Current economic analysis of the region by sector.

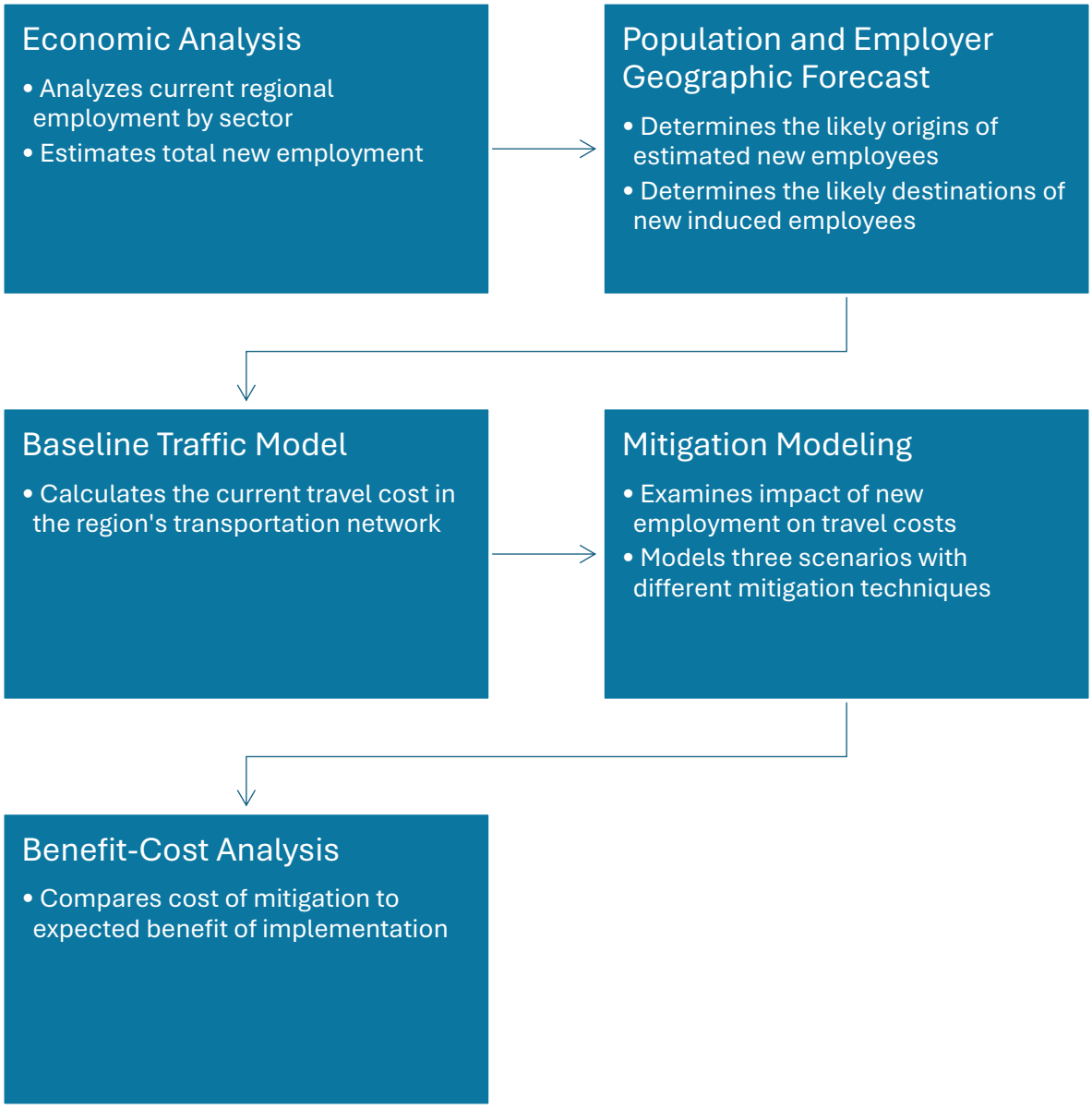
NAICS code	Description	Cupcakes Employment	Cupcakes Quotient	Location Quotient	Non-Basic Emp.	Basic Emp.
31-33	Manufacturing	28,090	23.39%	1.2694	22129	5,961
42	Wholesale trade	5,871	4.89%	0.7730	5871	0
44-45	Retail trade	8,902	7.41%	0.4856	8902	0
48-49	Transportation & warehousing	21,109	17.58%	5.5155	3827	17,282
51	Information	1,269	1.06%	0.3159	1269	0
52	Finance & insurance	2,315	1.93%	0.3028	2315	0
53	Real estate & rental & leasing	1,787	1.49%	0.8011	1787	0
54	Professional, scientific, & technical services	8,732	7.27%	1.2784	6830	1,902
56	Administrative support & waste management	4,113	3.42%	0.4272	4113	0
61	Educational services	250	0.21%	0.7672	250	0
62	Health care & social assistance	7,090	5.90%	0.3990	7090	0
71	Arts, entertainment & recreation	6,872	5.72%	3.3033	2080	4,792
72	Accommodation & foodservices	19,809	16.49%	1.5996	12384	7,425
81	Other services (except public admin.)	3,045	2.54%	0.7137	3045	0
	Other	849	0.71%	0.8177	849	0

The proposed Disconnected Semiconductors plant will increase local employment directly by approximately 2%, while the induced effects on area employment are estimated to increase area employment by approximately 5%.

This increase in regional employment will result in an estimated net population increase higher than any gain since 1950, assuming equivalent residential population to employment opportunities.

Methodology

Figure 1 – Descriptive workflow of the study modeling technique.



Economic Analysis

This study began with an economic analysis of the plant's impact on direct and indirect employment. Known employment at the factory was separated into basic and non-basic sectors, and basic sector employment was extrapolated to determine the regional impacts on induced non-basic employment growth in the region. A basic multiplier of 3.215 was determined using existing employment data for the region, leading to an estimated 3,986 non-basic employees induced of the 2,000 employees employed directly by Disconnected Semiconductors. The 200 non-basic employees at the plant were not included in the overall induced non-basic employment, and are considered as additional known employment.

Population and Employer Geographic Forecast

Employee residences were assumed to be spread evenly across the region following current population densities, as were induced non-basic employment locations. Origins and destinations were tabulated by neighborhood, to simplify traffic modeling. Residents working and living in the same neighborhood were not assumed to impact travel cost under this model.

Baseline Traffic Model

Assuming no significant congestion on land-based roadways, the analysis determined traffic volumes and travel times to and from the North and South Bridges. Existing employee origins and destinations were analyzed, with an assumed subset of this population traveling during the AM peak congestion period, and a percentage of vehicles occupied by carpooling travelers.

Commuters were assumed to take the path with the shortest travel time to their destination. Using traffic volumes, a tiered analysis on traffic congestion over each bridge was performed to determine the existing delay due to bridge capacity constraints. The shortest path had minor variability based on traffic congestion over the existing two bridges, with South Bridge experiencing less time delay due to lower traffic volumes.

Finally, a total travel cost, including vehicle time cost and traveler time cost, was calculated. This is used a baseline scenario, with further mitigation scenarios calculated in relation to this no-build current scenario.

Mitigation Modeling

Once new employment has been modeled by origin and destination, the study underwent modeling to compare the existing and impacted travel costs, as well as two mitigation measures used separately or in tandem.

This study compared the existing condition of the transportation network during the AM peak period with four alternative scenarios:

1. The introduction of the Disconnected Semiconductor employment with no mitigating factors.
2. The introduction of the Disconnected Semiconductor employment coinciding with the expansion of North Bridge to a 4-lane, 1400 vehicle-per-hour capacity roadway.
3. The introduction of the Disconnected Semiconductor employment with a coordinated Transportation Demand (TDM) program increasing commuting vehicle occupancy rates for all Northridge employees to 1.35 per vehicle.
4. The introduction of the Disconnected Semiconductor employment with both the aforementioned bridge expansion and the aforementioned TDM program.

Plant employees were noted to have higher rates of carpooling and a higher traveler time cost compared to existing residents and non-basic induced employees.

Each scenario utilized the same modeling technique as the baseline scenario, calculating a total travel cost based on overall distance traveled and congestion impact over the two existing (and in some scenarios, modified) bridges.

Benefit-Cost Analysis

Finally, annual travel costs were tabulated, and implementation of each mitigation strategy was amortized with a discount rate of 3% over a 30-year period to compare the annual cost and benefit of each scenario. The different mitigation concepts were then weighed against their cost of implementation. This includes the assumption of a 30-year loan covering the up-front cost of bridge expansion construction, which is noted as a significant determinant in the feasibility of the relevant mitigation scenarios.

Analysis

Overall, the use of either mitigation strategy alone or in combination produces an overall benefit over the no-mitigation scenario, decreasing the travel cost burden associated with the new plant's employment.

Table 4 - Total cost and cost per employment for four scenarios

Scenario	Description	Annual Total Cost of Scenario	Cost per Direct Employee	Cost per Total Area Employment Increase
2	No Mitigation	$2,459,506.62	$1,229.75/year	$410.85/year
3	New Bridge	$1,739,728.92	$869.86/year	$290.61/year
4	TDM Program	$2,240,466.23	$1,120.23/year	$374.26/year
5	Bridge + TDM	$1,723,007.95	$861.50/year	$287.82/year

While this study has not calculated the local economic impact in favor of new employment at the Disconnected Semiconductors plant, it is able to determine the annual travel cost associated per employee, which can be extrapolated to compare with an economic impact analysis. Dependent on mitigation scenarios, this may be in the range of $862-1230 per direct employee, or $288-$411 per regional employment increase.

Table 5 - Benefit-cost analysis of four mitigation scenarios.

Scenario	Description	Cost Increase over Baseline	Annual Amortized Cost of Implementation	Benefit-Cost Ratio	Priority
2	No Mitigation	$2,459,506.62	$0	n/a	n/a
3	New Bridge	$619,343.74	$1,120,385.19	1.64	High Priority
4	TDM Program	$2,090,466.23	$150,000.00	2.46	High Priority
5	Bridge + TDM	$452,622.76	$1,270,385.19	1.58	High Priority
5.2	*^ TDM portion*	-	-	1.11	Low Priority

While the benefit-cost ratio is a high priority for each mitigation strategy, their combined usage has the lowest ratio. While still considered an indication of high priority, this indicates a diminishing return on mitigation efforts.

The recommended TDM program has an excellent benefit-cost ratio of 2.46 by itself, and is recommended to be implemented at a minimum. It may also be useful to consider a similar program for the CBD neighborhood, if traffic congestion is high enough to warrant a significant travel cost benefit. The benefit of a TDM program is

diminished in a low-congestion scenario, however, as demonstrated by the low-priority benefit-cost ratio of the TDM program portion of the combined mitigation scenario.

The expansion of North Bridge has a high-priority favorability rating of 1.64, and would occur at the beginning of the time period. The TDM program is able to be implemented following the bridge expansion, and would then have a low-priority favorability rating of 1.11.

Recommendations and Conclusion

Modeling suggests that, in addition to other impacts new resident employment may increase, the transportation network will experience an additional annual travel cost burden between $1,723,008 and $2,459,507. Depending on different mitigation measures being implemented, the actual travel cost may be at different points along this scale, with the combination of an expanded North Bridge and a Travel Demand Management program producing the lowest cost burden. Given that the Disconnected Semiconductor facility is expected to increase the region's economic activity by a significantly higher amount, this study finds that transportation costs alone are being met, and encourages mitigation efforts to be implemented in conjunction with the new facility.

If up-front financing for construction on an expansion of North Bridge can be acquired, it is additionally recommended to do so. The amortized cost of this project over a standard 30-year period will provide a significant benefit to the region. Implementing the aforementioned TDM program in addition to the bridge expansion is still considered a positive benefit to costs, but is less cost efficient following the initial congestion reduction enabled by bridge expansion.

Lastly, this analysis assumed that new residents would live in the same areas as current residents. However, given the history of the region, it may be reasonable to develop a program encouraging new residents to settle in neighborhoods east of the river. This would reduce the strain on both of the region's bridges, and could serve to reinvigorate formerly vibrant working-class neighborhoods in the region. The 5% population increase expected due to this economic investment would provide significant justification to pursue larger regional goals around neighborhood development.

Appendix

Attached Calculations:

1. Economic Analysis
2. Geographic Forecast
3. Baseline Model
4. Scenarios:
    a. No Mitigation
    b. Bridge Expansion
    c. TDM Program
    d. Bridge + TDM
5. Benefit-Cost Analysis

Figure 2 - Analysis of shortest paths to the Northridge neighborhood.