GEO 4427

April 23rd, 2025

City of New Braunfels Walkability Analysis

Names:

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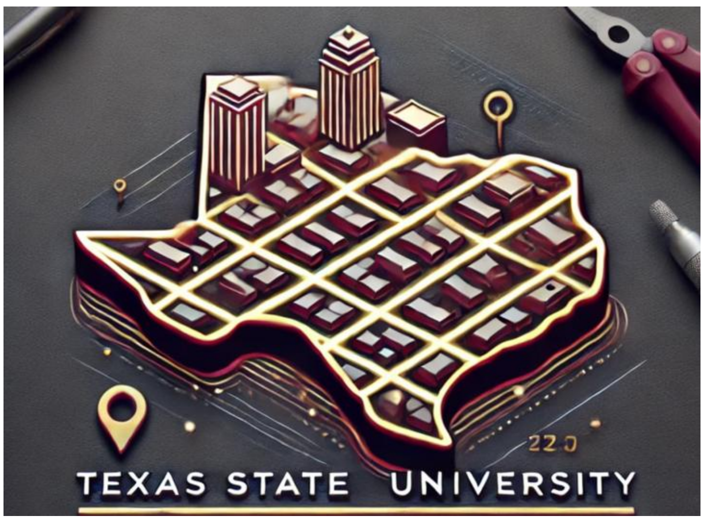
Evan Riojas



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Special Thanks

Thank you to the City of New Braunfels's GIS team for their dedicated support, kind words of encouragement, and guidance throughout this project.

Thank you to Dr. Yuan and Arup Acharjee for their help and assistance throughout the project.

Thank you to the team behind this!

Abstract

This project aims to digitize satellite imagery from the City of New Braunfels into a digital database of sidewalks, crosswalks, gaps, and disconnects defined by the provided schema. This is to create a foundation for the City of New Braunfels' five-year plan to make the city both more accessible and navigable for students in areas with no transport zones. This database is important because of the age of the city, as older developments have a general lack of cohesive development of sidewalks and crosswalks, which can cause large gaps between sidewalks or general disconnections where sidewalks end. This affected older schools the hardest as they lacked sidewalks in surrounding developments, while new developments had ample sidewalks. This shows both the need for more accessible sidewalks and crosswalks in older developments that would increase student mobility.

Introduction

The City of New Braunfels, in collaboration with Texas State University students in the GIS consulting class (GEO4427), is embarking on a project to develop a comprehensive Student

Pedestrian Walkability GIS dataset, a crucial undertaking aimed at bolstering the city's planning and transportation initiatives. This project's primary objective is to meticulously inventory the city's sidewalk and crosswalk infrastructure by leveraging high-resolution aerial imagery and street-level photography. Utilizing GIS software, student participants will engage in heads-up digitizing to create a detailed geodatabase of these pedestrian assets. The ultimate goal is to conduct a thorough network connectivity analysis, generate pertinent metrics related to walkability, and produce insightful map products that specifically address student access to schools and parks, with a keen focus on accessibility considerations. This effort promises to yield valuable insights into the existing pedestrian network, pinpointing areas of connectivity gaps and informing plans and policies designed to foster walkable environments, particularly around key community centers. The data derived from this project will serve as a foundational resource for the City of New Braunfels' five-year plan dedicated to enhancing sidewalks and pedestrian mobility.

This initiative extends beyond mere data collection, offering significant educational benefits to the participating students. They will gain invaluable hands-on experience in various facets of GIS, including data architecture design, precise asset digitization, sophisticated network analysis techniques, rigorous quality control procedures, and the creation of professional-grade deliverables. This real-world application of geospatial technology will foster the development of crucial GIS skills and provide students with direct exposure to how local government entities utilize these tools for urban planning and infrastructure management. The scope of the project is clearly defined, encompassing the creation of a geodatabase (fcWalkabilityPrimary) containing a comprehensive inventory of sidewalks and crosswalks relevant to student pedestrian activity within New Braunfels. This involves attributing features with essential information such as location, connectivity status (connected, disconnected, gap), and sidewalk width. The project timeline spans from January to April 2025, and the final deliverables will include the complete GIS dataset, a comprehensive project report, a public-facing website summarizing the project's findings, and all associated supporting documentation. This detailed and systematic approach ensures a robust and valuable outcome for both the City of New Braunfels and the participating students.

Data

The data was fully provided by the city of New Braunfels' GIS department. Besides the data provided (see tables below), the group would also cross-reference the aerial imagery with Google Earth data to properly ascertain where sidewalks might be in cases where the aerial imagery proved inconclusive. The data provided by the city of New Braunfels was of high accuracy, though the accuracy of Google Earth could sometimes be inaccurate due to issues with certain neighborhoods not having updated street imagery up to 2024-2025.

The data was necessary as it was the basis for all of our digitization and analysis work. The aerial imagery served as the visual guide for us being able to accurately trace and digitize sidewalks as well as find the proper disconnects and gaps. We expanded the existing sidewalk system extensively and added all gaps and disconnects where the criteria were applicable. The attributes provided were absolutely important to the entire classification of the project and analysis. Attributes like MSAGNamee were for being able to identify the location of streets, while attributes like featuretype and featuretype2 would be used for classification between sidewalks and crosswalks and between connected and disconnected/gaps, respectively.

Master Data List

Entity	Attributes	Spatial Object	Status	Source	Unit	Year
fcWalkabilityEditing	OBJECTID MSAGname sideOfStreet featureType featureType2 sidewalkWidth Shape_Length	polyline	available	City of New Braunfels GIS	Survey Feet	2025
fcWalkabilityExisting	OBJECTID MSAGname sideOfStreet facilityType facilityType2 sidewalkWidth assetID Comments Shape_Length	polyline	available	City of New Braunfels GIS	Survey Feet	2025
fcWalkabilityPrimary	OBJECTID MSAGname sideOfStreet featureType featureType2 sidewalkWidth Shape_Length	polyline	available	City of New Braunfels GIS	Survey Feet	2025

Notes:

fcWalkabilityEditing - The dataset where edits will be conducted. Features are to be edited in this location.

fcWalkabilityExisting - Existing dataset provided by the CoNB. Features are to be attributed, and gaps are to be digitized. QA/QC of the existing features.

fcWalkabilityPrimary - The primary dataset where completed grids will be appended to following the QA/QC of the completed grid. Grids are to be connected to adjacent grids.

Data List

Field	**Attribute**	**Definition**
LengthShape()		Automatic attribute assigned by software.
OBJECTID		An automatic ID number is assigned by the software
MSAGNamee		The street name is derived from the street centerlines dataset.
sideOfStreet	Left, Right	Directional side of the street.Z
featureType	Sidewalk	
	Crosswalk	The portion of the street or highway right-of-way beyond the curb is intended for pedestrian usage.
featureType2	Connected	A sidewalk or crosswalk segment that seamlessly connects to another segment of sidewalk or crosswalk on both ends.
	Gap (Sidewalk only)	A section where the sidewalk ends and resumes within the same block, but continuity is interrupted.

	Disconnected (Sidewalk only)	The terminal 10 feet of a sidewalk or crosswalk segment that does not connect to another segment or a crossing point at an intersection.
sidewalkWidth		Measurement in feet between the two edges of a sidewalk.

Methods

The problem addressed is the digitizing of the City of New Braunfels sidewalks, crosswalks, and gaps between sidewalks. The data was processed by members assigning themselves a grid within the City of New Braunfels. These grids are outlined at the priority level by the client and will be processed as such, starting with high-priority and ending with low-priority grids. Next, members update their tracking grid to “claim” the grid, ensuring that it isn't manipulated by someone else while being edited by the user. This beginning process is essential because it ensures that the workflow is efficient and without conflict.

After assigning a grid, the next step was to begin digitizing features in, **fcWalkabilityEditing**, using ArcGIS Pro within the assigned grid. To digitize the features, use the Walkability Edit Map to create features along sidewalks imaged in the Imagery/OrthoImagery layer. The general rules outlined by the client, City of New Braunfels, are as follows:

- Avoid bends/curves or arcs, and use right angles when possible.
- Start and end segments at ramps, crosswalks, medians, bridges(or pedestrian refuge islands), etc.
- Try to draw lines down the center of the feature.

- Map sidewalks parallel to the street when creating sidewalks by a park (Not through).
- Map external sidewalks adjacent to a school building (Do not map sidewalk entrances leading to a building or internal walkways).
- MSAGname is identified as parallel to the sidewalk, ramp, or crosswalk direction.
- Map sidewalks parallel to the street when by a Business (Not the business's private sidewalks).
- If geoImagery is poor and can not measure the width, put in comments.
- If a sidewalk or buffer width varies in measurement, put in comments.
- Editing should only be on sidewalks.
- The side of the street is determined by the direction of the street, characterized by an arrow.
- Ramps- Fill out the location if applicable.
- Crosswalks - Fill out Location and Traffic control.
- Only measure the width of the driveway when the sidewalk is visible on it.
- Driveways perpendicular to the sidewalk passing through it are digitized as sidewalks, not crosswalks.
- Do not map ramps going to parking lots with no adjacent sidewalk connectivity.
- Crosswalks can exist only if ramps are on both sides of the street.
- Crosswalks with ramps will be marked as connected even without markings.
- Only sidewalks can be marked as gaps.

The key question to be answered here is: “Whether pedestrian facilities connect people to key destinations, and if not, where are the gaps in connectivity?”

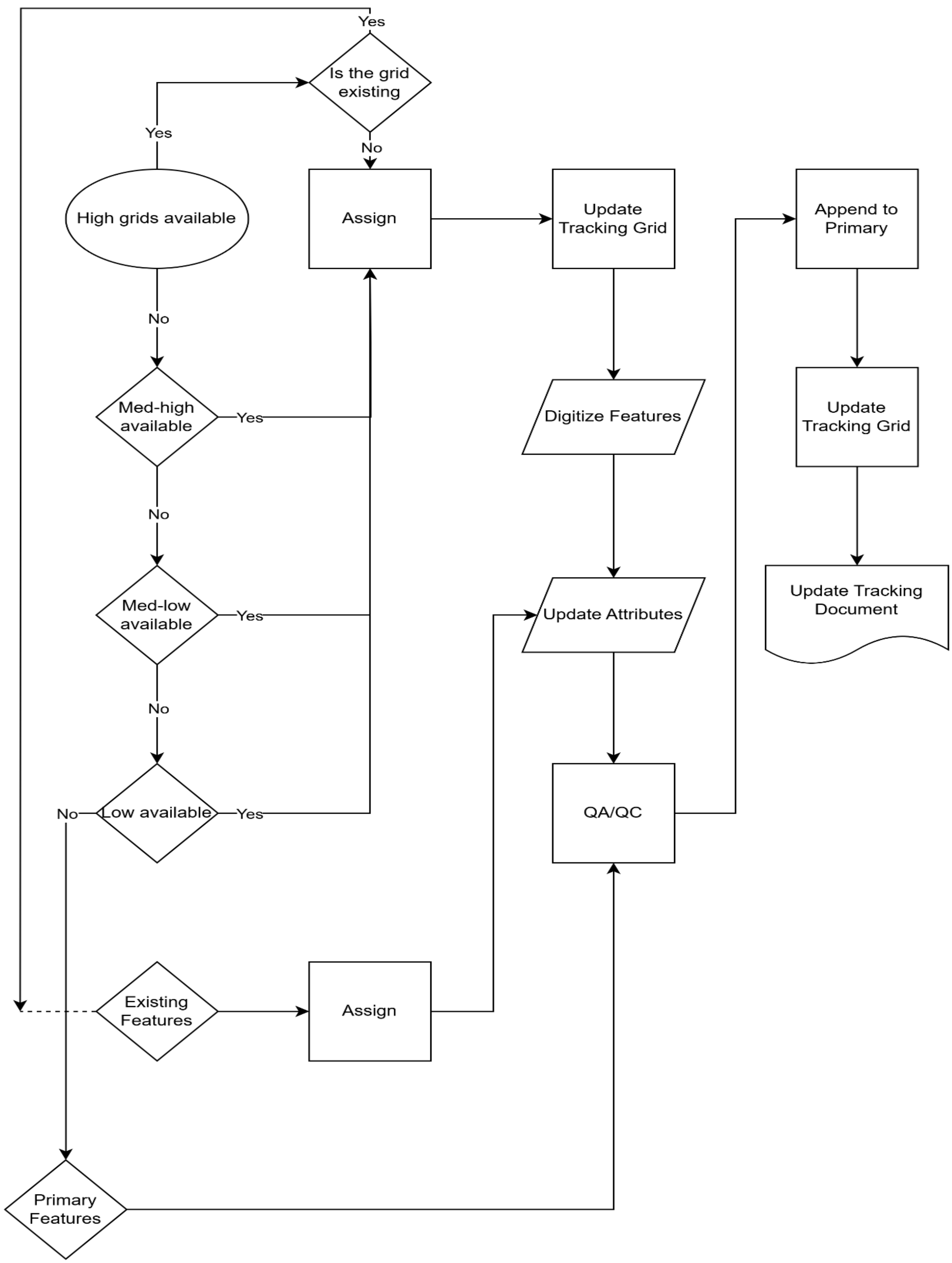
When digitizing the sidewalk and crosswalk features in the designated grid, members continually update the attribute features according to the above data list in **section 3.2**, detailing whether sidewalks are connected or disconnected, whether gaps are present, and whether crosswalks are present. The most important method to this part is to efficiently digitize the features in the centerline of sidewalks, because of the nature and the size of the area, this step in the methodology will take the longest by far, but is relatively simple.

Grid Index Breakdown

Name	**High**	**Mid-high**	**Mid-Low**
Avery Bouskila	**85**, **87**	68, 69, 83, 127	121, 132
Audrey Hurtado	**100**, **102**	86, 99, 101, 138	98, 111, 112
Josh Faircloth	113, 126	125, 136, 144,	115, 88, 104
Evan Riojas	137,**145**	84, 114, 146	43, 44, 59

**Bold numbers represent fcWalkabilityExisting grids.*

Workflow


Yes
Is the grid existing
Yes
No
High grids available
Assign
Update Tracking Grid
Append to Primary
No
Med-high available
Yes
Digitize Features
Update Tracking Grid
No
Med-low available
Yes
Update Attributes
Update Tracking Document
No
No
Low available
Yes
QA/QC
Existing Features
Assign
Primary Features

Analysis Methods

All grids were appended together in a systematic procedure. Firstly, one member would email another their completed grids. This project would then be opened in a different created folder. Secondly, the **fcWalkabilityEDITING** layer of the other member's file would be dragged from the folder and dropped into the current project, where it would be renamed fcWalkabilityAPPEND. Thirdly, the append tool would be used with **fcWalkabilityAPPEND** as input and **fcWalkabilityEDITING** as the target dataset. Finally, the layers are checked to see where lines are connected with the modified Edit Vertices tool used to seamlessly connect the appended layers. The collective layers needed to be appended to ensure an overarching and thorough analysis of the sum of the gaps and disconnects of “no-transport” areas that intersect multiple grids.

The first form of analysis that was utilized was Numerical Summarization analysis, which was used to determine both the total number of gaps and disconnects, the total length of gaps, and the ratio between schools of the same grade. Firstly, the non-transportation zone of a particular school would be selected within the attribute table of the SchoolNoTransportationZones layer. Secondly, the select by location tool and the select by attributes tool on **fcWalkabilityEDITING** to set the selection type to remove where facilitytype2 is equal to D and G. D stands for disconnects, and G stands for gaps. This creates a selection of only the gaps and disconnects of a clipped school layer. Secondly, right-click on the facilitytype2 column to use and visualize the gaps and disconnects for better analysis. The number of gaps and disconnects is counted, with the length of each gap recorded and added together for the full length of a given school area. Lastly, the total summary length of the gaps from all school areas of the same grade is added together. The total length of gaps in a single school's no transport zone is then divided by the total length of gaps in a grade's no transport zone times one hundred to calculate the ratio of gaps between individual schools within a grade.

Kernel density estimation effectively visualizes the spatial clustering of sidewalk gaps and disconnections, particularly in relation to school locations. By applying this technique to digitized infrastructure deficiencies, it intuitively highlights areas with high concentrations of these issues, powerfully underscoring the neighborhoods and pedestrian routes most affected by fragmented sidewalk networks. Overlaying the resulting density map with the locations of older schools can visually corroborate the correlation between older educational institutions and a greater number of sidewalk gaps and discontinuities, providing a clear and persuasive illustration of this observed trend.

These kernel density maps serve as a practical decision-making tool for the City of New Braunfels' five-year plan, allowing for the prioritization of areas with the highest density of sidewalk gaps and disconnects, especially near schools and within no-transport zones, for immediate intervention and resource allocation. Furthermore, comparing a kernel density map of existing sidewalks with the gap/disconnect density map can visually articulate disparities in sidewalk coverage between older and newer developments. While network connectivity analysis provides quantitative walkability metrics, kernel density estimation offers crucial spatial context, visually highlighting areas where enhanced connectivity is most needed and enriching the project's overall understanding of the city.

Budget and Timeline

4.1 Budget

GIS Analysts

Total Hours (16 hours/week * 14 weeks * 4 analysts) - 896

Hourly Pay - $32.00

Total - $28,672.00

Project Manager

Total Hours (16 hours/week * 14 weeks *1 PM) - 224

Hourly Pay - $42.00

Total - $9,408.00

TOTAL COSTS: $38,080

4.2 Timeline

Phase 1: Digitizing

The first and largest of the phases will be about 7 weeks of digitization work. The entirety of the project revolves around this work as we specifically look for and fix gaps in sidewalks in high-priority "no-travel" zones, as well as other lesser-prioritized zones farther away from school zones. Thanks to the diligent work of the City of New Braunfels GIS Department, we already have the necessary collected data and just need to process it where needed.

Phase 2: Quality Control

The second phase will happen concurrently with the first phase, as our work is checked and corrected for any possible user errors. Individual periods of QC after digitization should be no more than a week or two long and will also fall at the beginning of phase 3.

Any possible errors that might be beyond the ability of the team to fix will also be recorded and saved to bring up to the City of New Braunfels team during the weekly meeting for assistance.

Phase 3: Analysis

The third phase will be roughly 3-4 weeks and will involve analyzing the results of our complete digitization process. In this phase, we will draw conclusions from which grids require the most attention based on criteria such as multiple incomplete sidewalks, inadequate ramps, and proximity to school zones.

Phase 4: Final Project Report

The final phase will be a 4-week period where we work on the final report from our fully digitized data and analysis. The final report will consist of a written report of 15-20 pages, a website, and all necessary files to be included as deliverables to Dr. Yuan and the City of New Braunfels.

Timetable

January 2025						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	***22***	23	24	25
26	27	28	29	30	31	

February 2025						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	***24***	25	26	27	28	

March 2025						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2	3	4	5	6	7	8
9	10	11	12	13	***14***	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	***31***					

April 2025						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	***23***	24	25	26
27	***28***	29	30			

Important Dates:

January 22 - First client visit

February 24 - Second client visit

March 14 - Digitization deliverables due to the City of New Braunfels

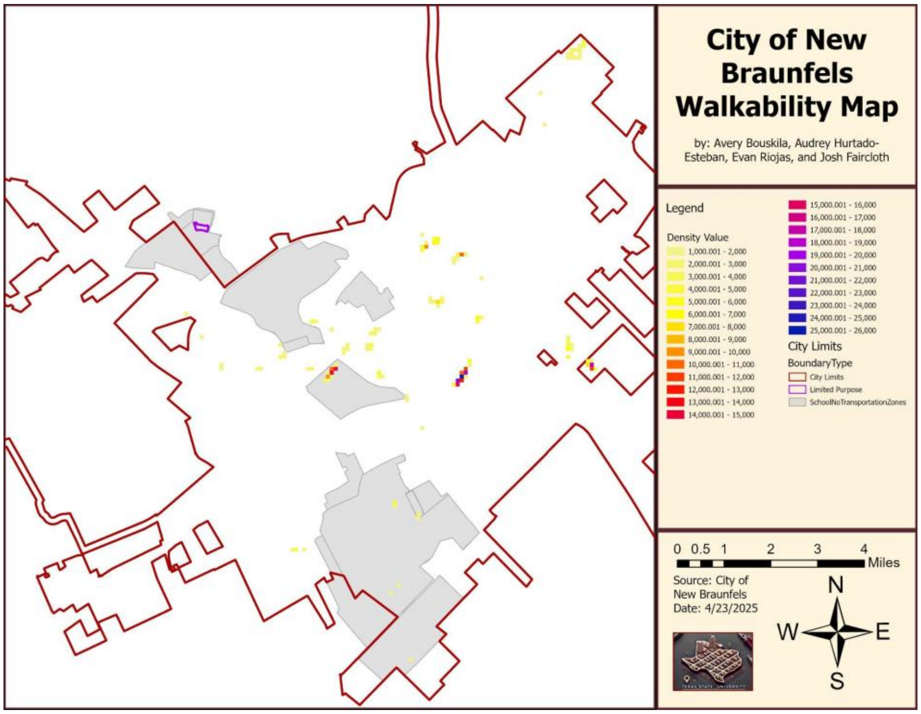
March 31 - Third client visit

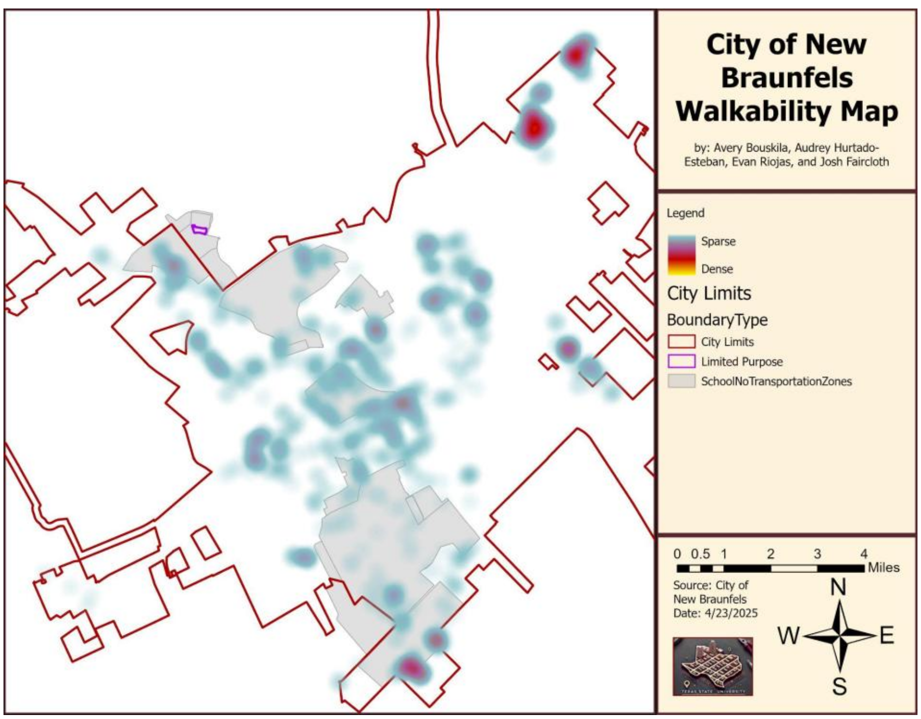
April 23 - General final deliverables due

April 28 - Final client visit/Presentations

Results

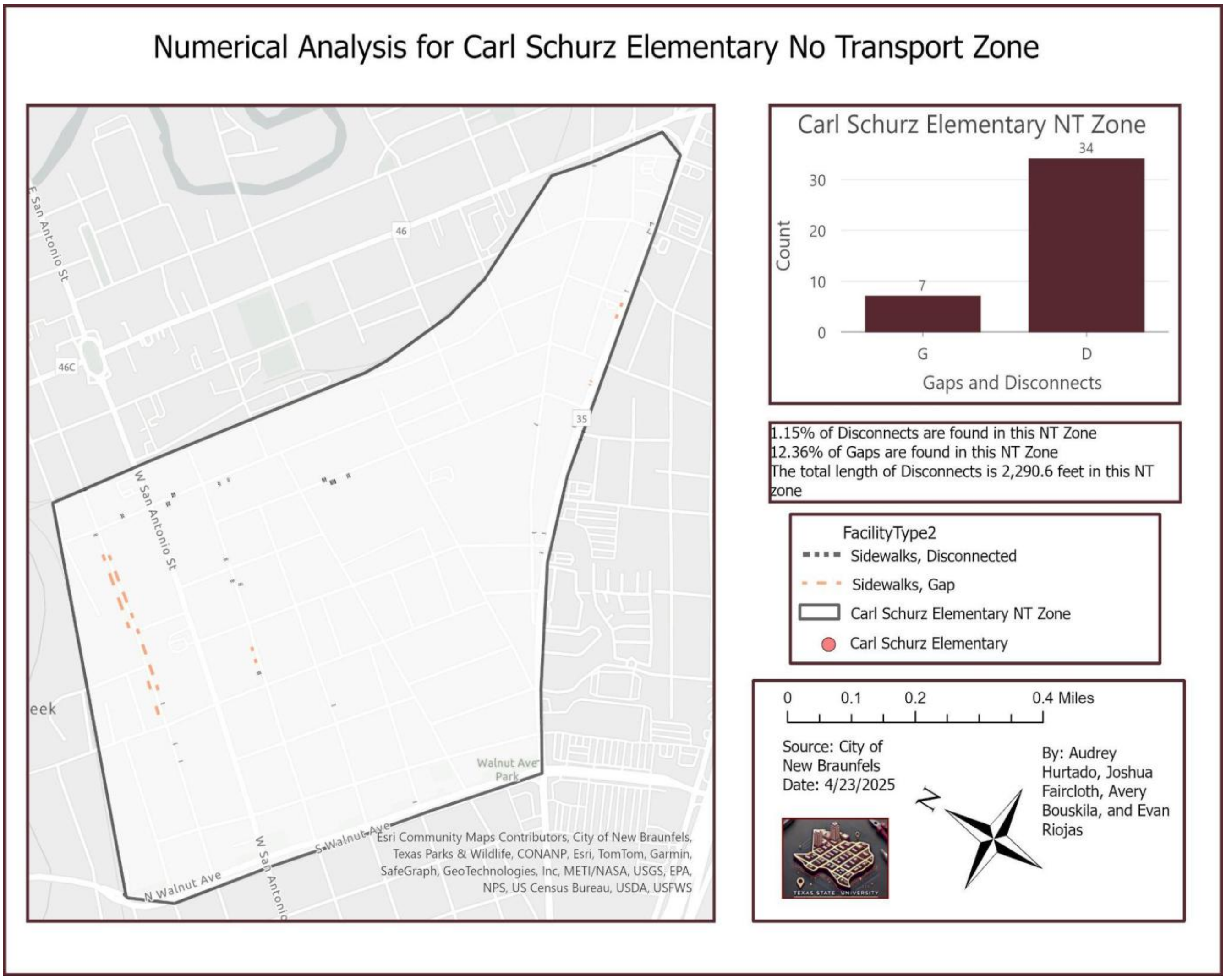
a. Kernel Analysis

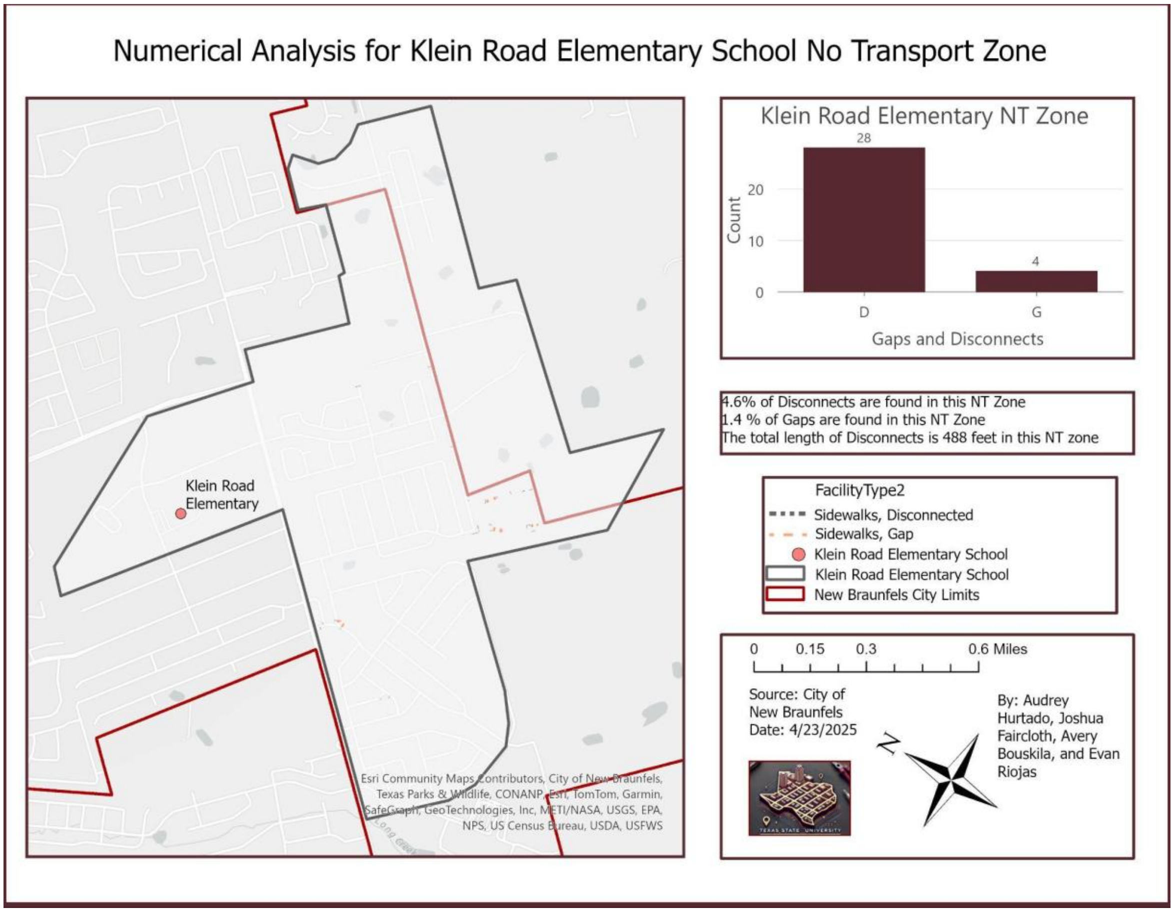


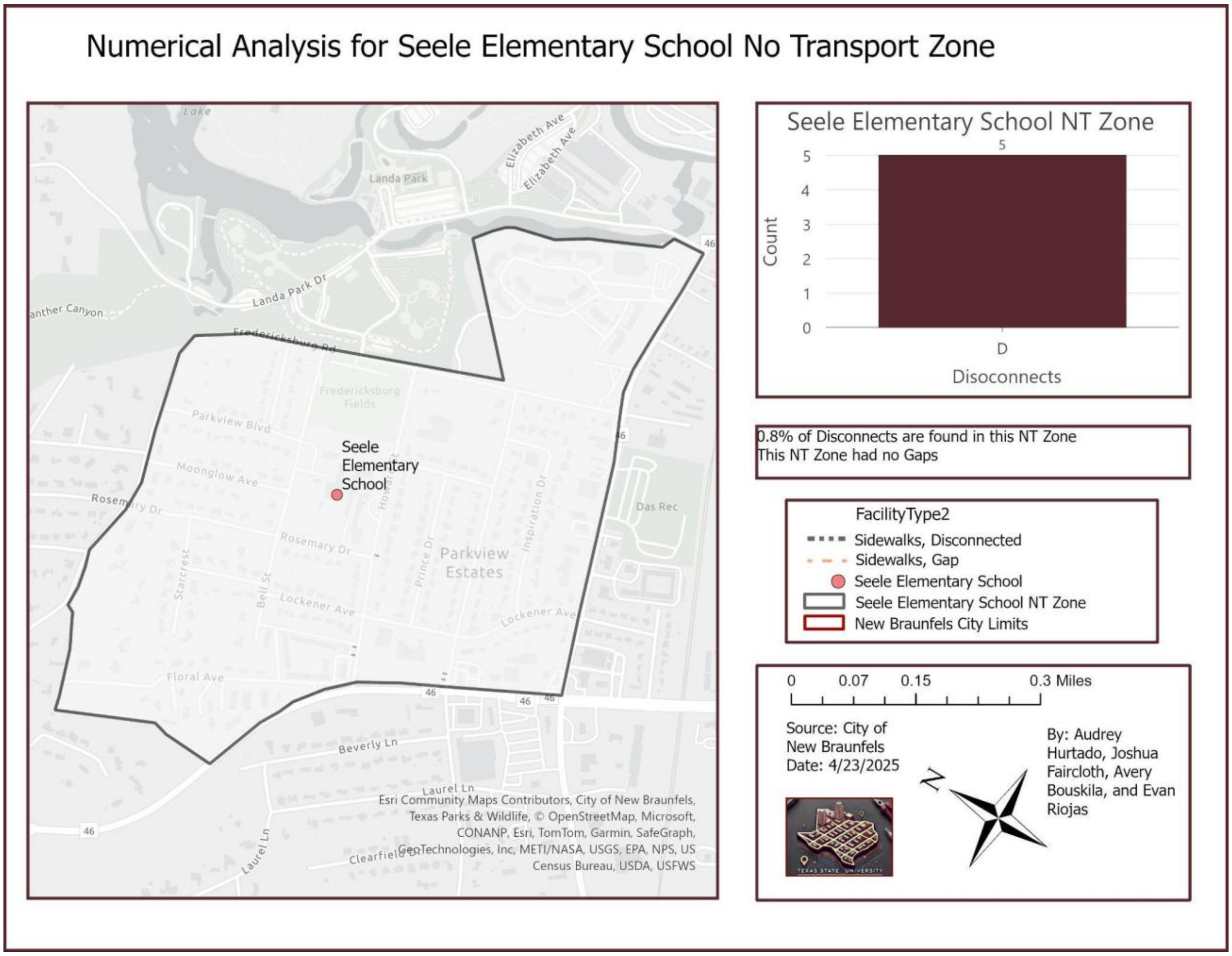


In the Kernel analysis, a utilization of the gap and disconnected polyline features allowed for an accurate weighted assessment of the clustering of features. Features received a score based on their proximity and length in comparison to other nearby features with a distance of 200 meters, this data was then converted into a raster with a cell size of 250 meters. Analyzing the raster there are high concentrations of gaps and disconnects inside downtown old New Braunfels, with other significant clusters being in developing communities on the outskirts of New Braunfels. This can also be seen in the heat map analysis which utilized the middle of polyline features as points and then compared the clustering with a search radius of 200 meters. The most dense areas were in developing communities with the more spread out gaps and disconnects being in downtown old New Braunfels. Overall the Kernel analysis provided valuable insight into clusters of gaps and disconnects that can be easily fixed with minimal resource investment.

b. Individual School Type Numerical Analysis




Numerical Analysis for Klein Road Elementary School No Transport Zone
Klein Road Elementary
Esri Community Maps Contributors, City of New Braunfels, Texas Parks & Wildlife, CONANP, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS
Klein Road Elementary NT Zone
28
4
Count
0
10
20
D
G
Gaps and Disconnects
4.6% of Disconnects are found in this NT Zone
1.4 % of Gaps are found in this NT Zone
The total length of Disconnects is 488 feet in this NT zone
FacilityType2
Sidewalks, Disconnected
Sidewalks, Gap
Klein Road Elementary School
Klein Road Elementary School
New Braunfels City Limits
0 0.15 0.3 0.6 Miles
Source: City of New Braunfels
Date: 4/23/2025
By: Audrey Hurtado, Joshua Faircloth, Avery Bouskila, and Evan Riojas
N


Numerical Analysis for Seele Elementary School No Transport Zone
Seele Elementary School
Landa Park
Landa Park Dr
Fredericksburg Rd
Fredericksburg Fields
Parkview Blvd
Moonglow Ave
Rosemary Dr
Lockener Ave
Floral Ave
Parkview Estates
Inspiration Dr
Prince Dr
Bell St
Starcrest
Das Rec
Beverly Ln
Laurel Ln
Clearfield Dr
Elizabeth Ave
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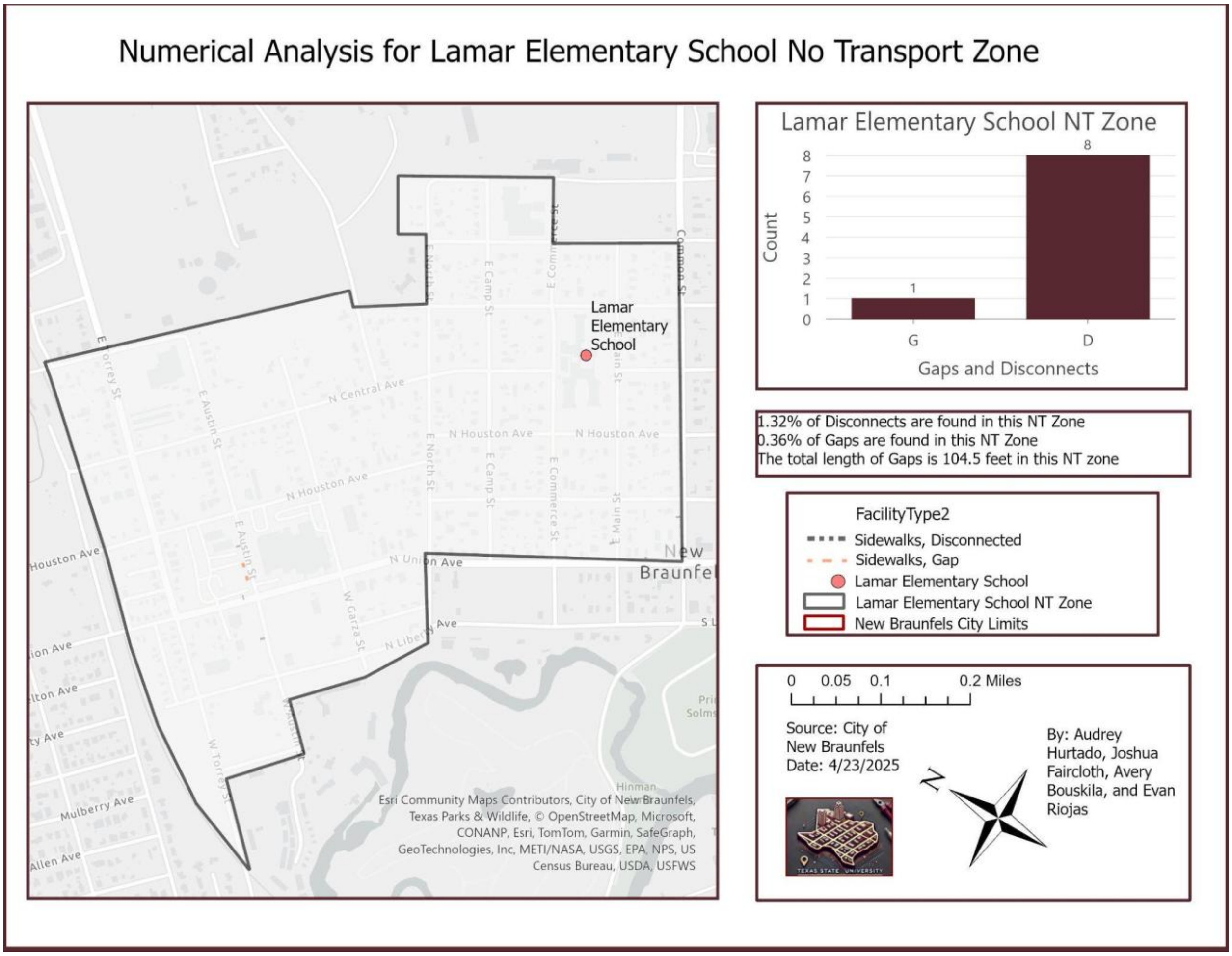
Seele Elementary School NT Zone
Count
Disoconnects
D
5
0.8% of Disconnects are found in this NT Zone
This NT Zone had no Gaps
FacilityType2
Sidewalks, Disconnected
Sidewalks, Gap
Seele Elementary School
Seele Elementary School NT Zone
New Braunfels City Limits
0 0.07 0.15 0.3 Miles
Source: City of New Braunfels
Date: 4/23/2025
By: Audrey Hurtado, Joshua Faircloth, Avery Bouskila, and Evan Riojas
N


Numerical Analysis for Lamar Elementary School No Transport Zone
Lamar Elementary School NT Zone
8
1
Count
G
D
Gaps and Disconnects
1.32% of Disconnects are found in this NT Zone
0.36% of Gaps are found in this NT Zone
The total length of Gaps is 104.5 feet in this NT zone
FacilityType2
Sidewalks, Disconnected
Sidewalks, Gap
Lamar Elementary School
Lamar Elementary School NT Zone
New Braunfels City Limits
0 0.05 0.1 0.2 Miles
Source: City of New Braunfels
Date: 4/23/2025
By: Audrey Hurtado, Joshua Faircloth, Avery Bouskila, and Evan Riojas
N
Lamar Elementary School
N Central Ave
N Houston Ave
N Union Ave
N Liberty Ave
Mulberry Ave
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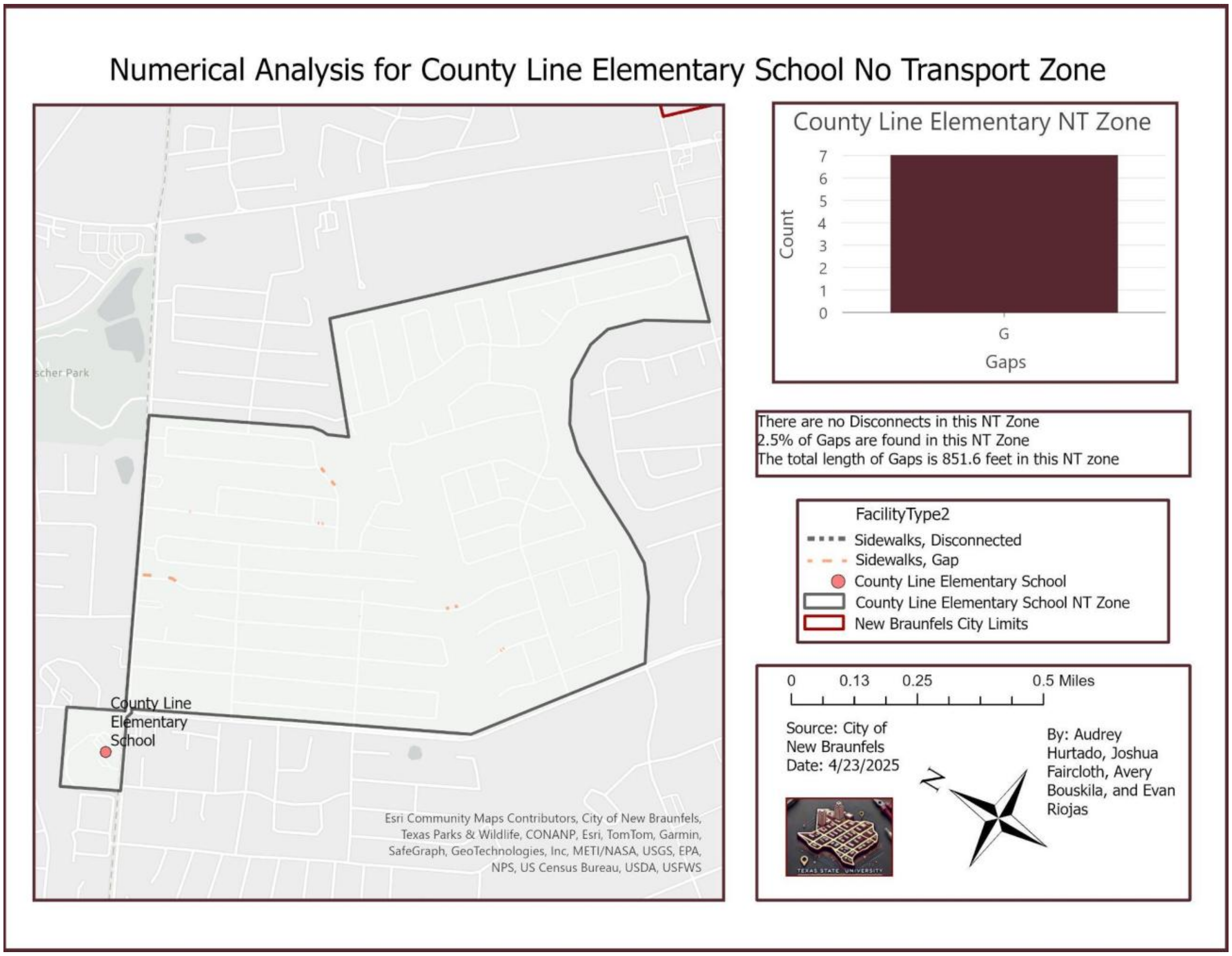
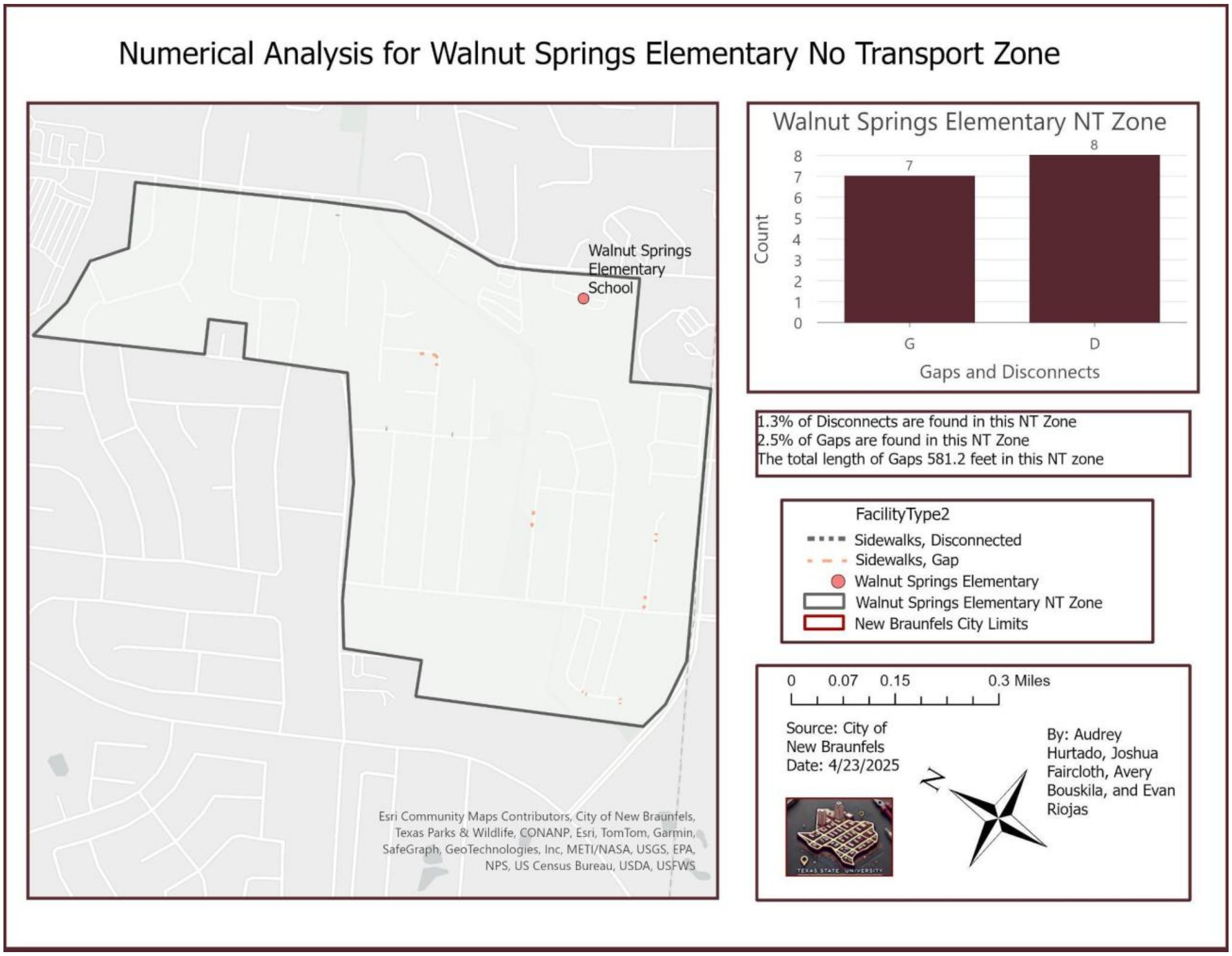
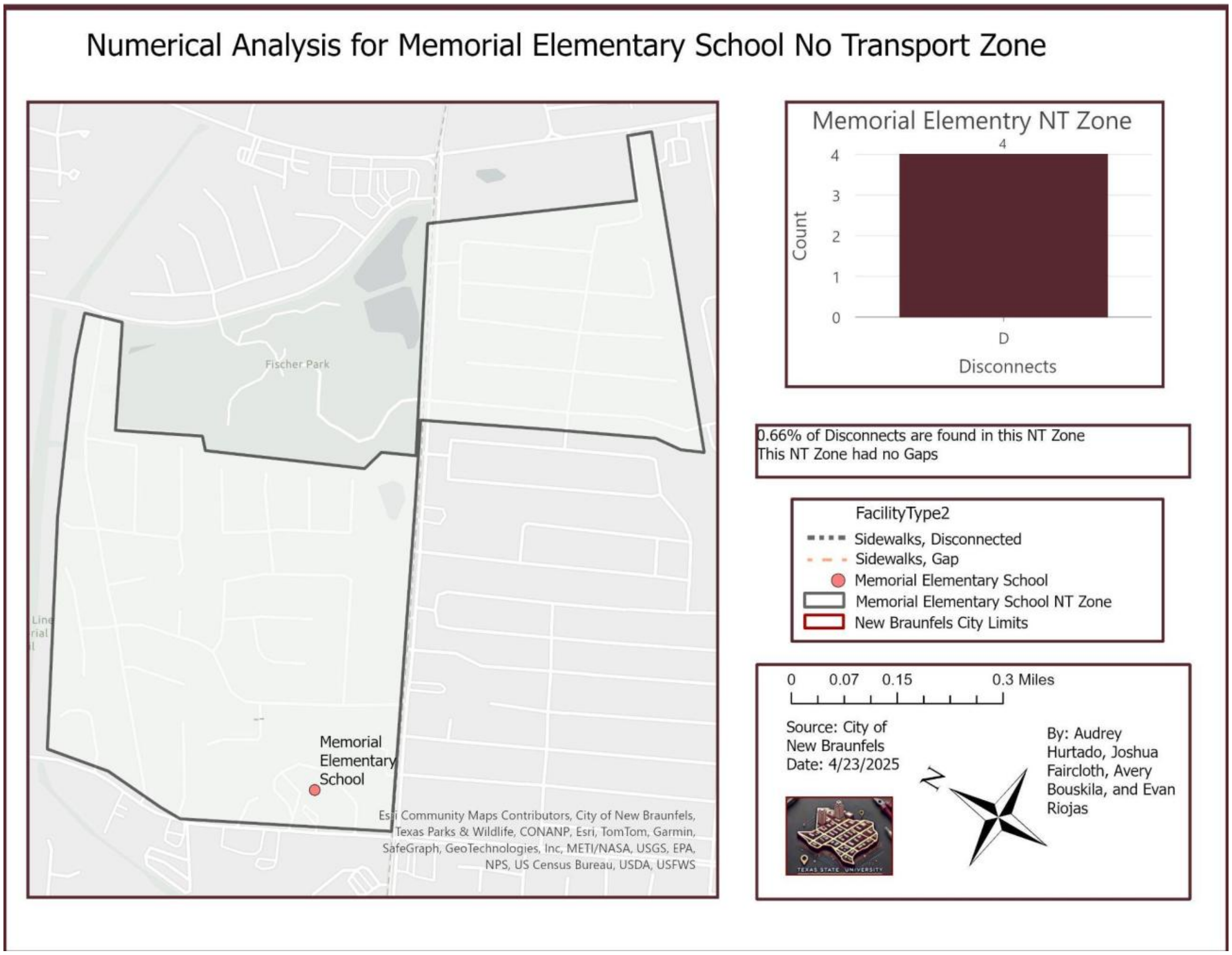
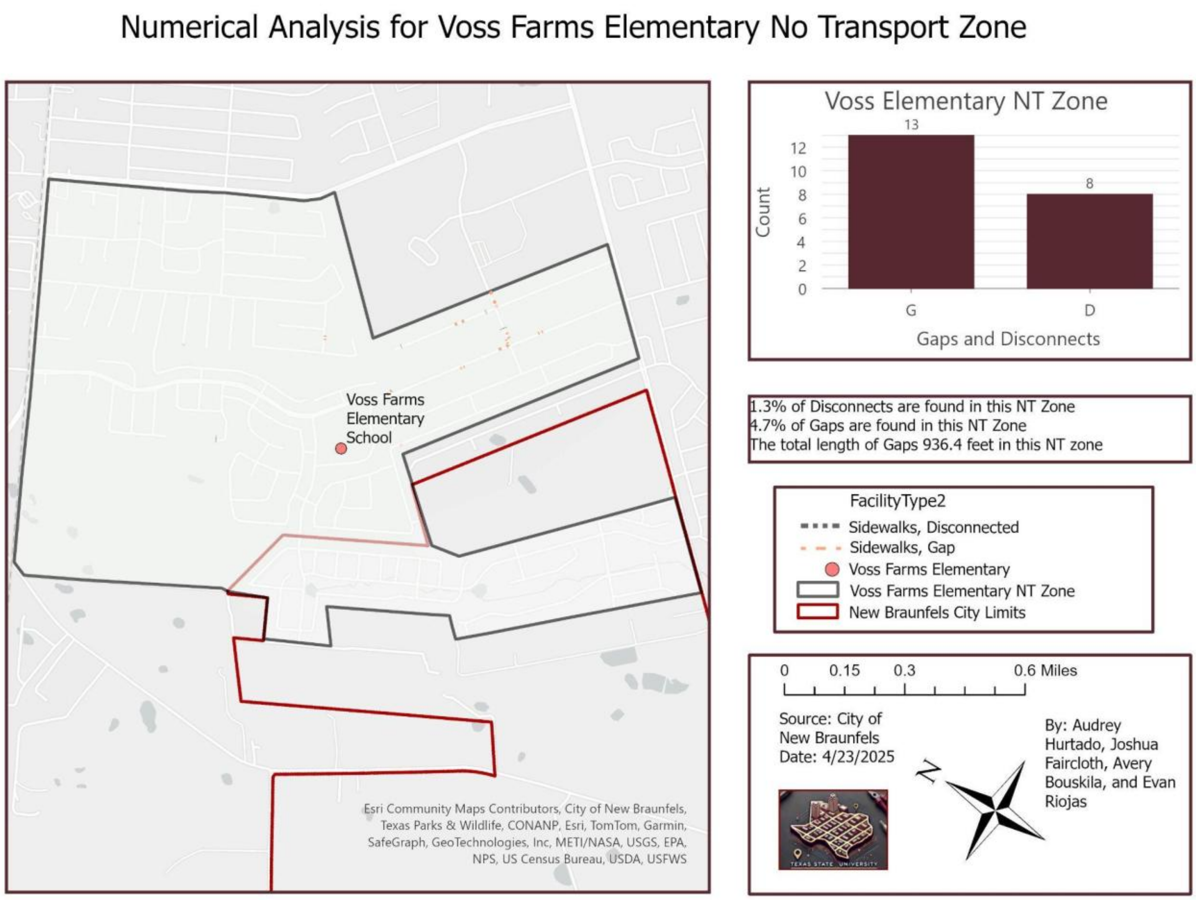
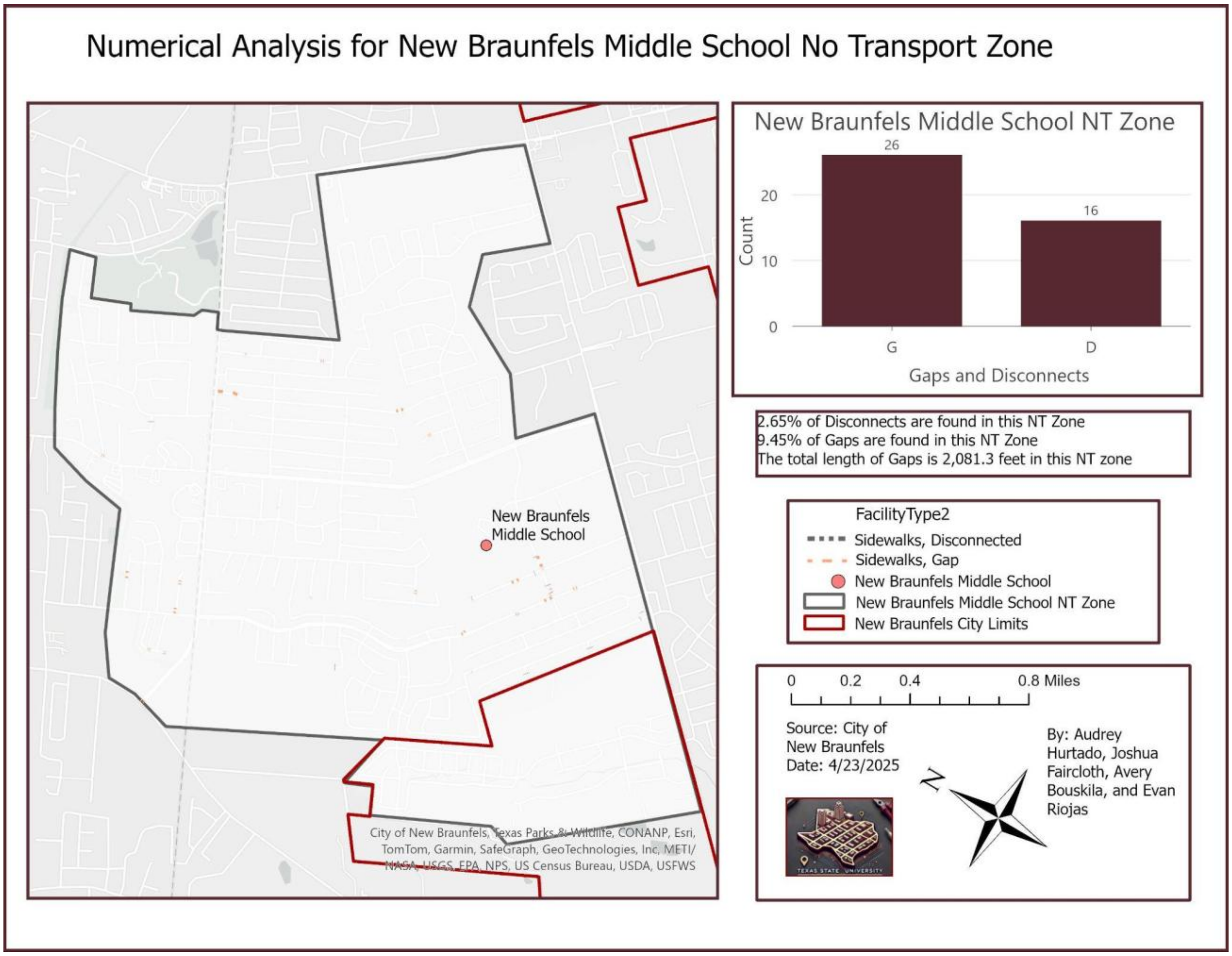
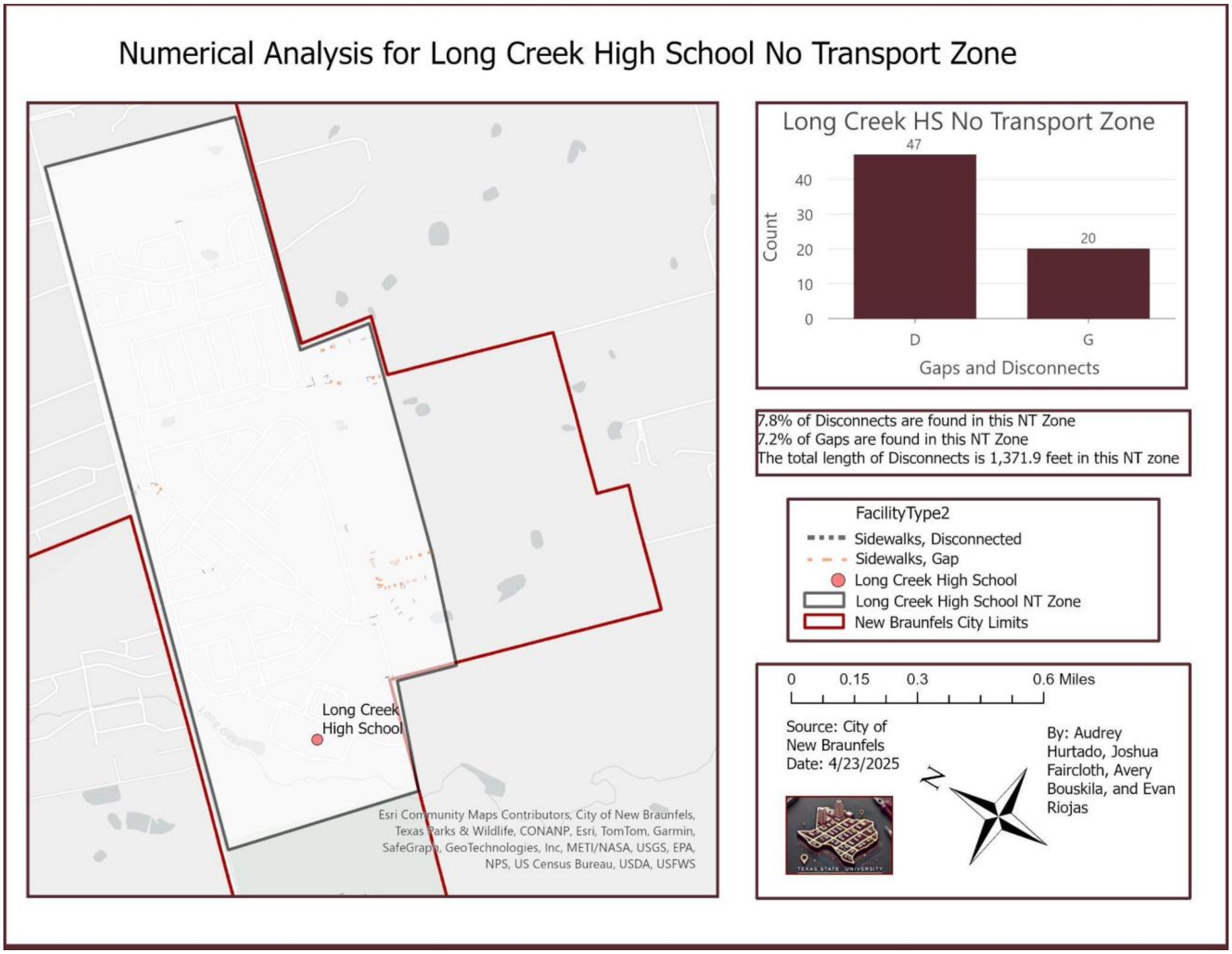

Numerical Analysis for County Line Elementary School No Transport Zone
County Line Elementary NT Zone
Count
Gaps
G
7
6
5
4
3
2
1
0
There are no Disconnects in this NT Zone
2.5% of Gaps are found in this NT Zone
The total length of Gaps is 851.6 feet in this NT zone
FacilityType2
Sidewalks, Disconnected
Sidewalks, Gap
County Line Elementary School
County Line Elementary School NT Zone
New Braunfels City Limits
0
0.13
0.25
0.5 Miles
Source: City of New Braunfels
Date: 4/23/2025
By: Audrey Hurtado, Joshua Faircloth, Avery Bouskila, and Evan Riojas
N
County Line Elementary School
Esri Community Maps Contributors, City of New Braunfels, Texas Parks & Wildlife, CONANP, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS


Numerical Analysis for Walnut Springs Elementary No Transport Zone
Walnut Springs Elementary School
Esri Community Maps Contributors, City of New Braunfels, Texas Parks & Wildlife, CONANP, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS
Walnut Springs Elementary NT Zone
Count
0
1
2
3
4
5
6
7
8
7
8
G
D
Gaps and Disconnects
1.3% of Disconnects are found in this NT Zone
2.5% of Gaps are found in this NT Zone
The total length of Gaps 581.2 feet in this NT zone
FacilityType2
Sidewalks, Disconnected
Sidewalks, Gap
Walnut Springs Elementary
Walnut Springs Elementary NT Zone
New Braunfels City Limits
0 0.07 0.15 0.3 Miles
Source: City of New Braunfels
Date: 4/23/2025
By: Audrey Hurtado, Joshua Faircloth, Avery Bouskila, and Evan Riojas
N


Numerical Analysis for Memorial Elementary School No Transport Zone
Memorial Elementry NT Zone
Count
Disconnects
D
0.66% of Disconnects are found in this NT Zone
This NT Zone had no Gaps
FacilityType2
Sidewalks, Disconnected
Sidewalks, Gap
Memorial Elementary School
Memorial Elementary School NT Zone
New Braunfels City Limits
0 0.07 0.15 0.3 Miles
Source: City of New Braunfels
Date: 4/23/2025
By: Audrey Hurtado, Joshua Faircloth, Avery Bouskila, and Evan Riojas
Fischer Park
Memorial Elementary School
Esri Community Maps Contributors, City of New Braunfels, Texas Parks & Wildlife, CONANP, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS


Numerical Analysis for Voss Farms Elementary No Transport Zone
Voss Farms Elementary School
Esri Community Maps Contributors, City of New Braunfels, Texas Parks & Wildlife, CONANP, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS
Voss Elementary NT Zone
13
8
Count
G
D
Gaps and Disconnects
1.3% of Disconnects are found in this NT Zone
4.7% of Gaps are found in this NT Zone
The total length of Gaps 936.4 feet in this NT zone
FacilityType2
Sidewalks, Disconnected
Sidewalks, Gap
Voss Farms Elementary
Voss Farms Elementary NT Zone
New Braunfels City Limits
0 0.15 0.3 0.6 Miles
Source: City of New Braunfels
Date: 4/23/2025
By: Audrey Hurtado, Joshua Faircloth, Avery Bouskila, and Evan Riojas
N


Numerical Analysis for New Braunfels Middle School No Transport Zone
New Braunfels Middle School NT Zone
26
16
20
10
0
Count
G
D
Gaps and Disconnects
2.65% of Disconnects are found in this NT Zone
9.45% of Gaps are found in this NT Zone
The total length of Gaps is 2,081.3 feet in this NT zone
FacilityType2
Sidewalks, Disconnected
Sidewalks, Gap
New Braunfels Middle School
New Braunfels Middle School NT Zone
New Braunfels City Limits
New Braunfels Middle School
0 0.2 0.4 0.8 Miles
Source: City of New Braunfels
Date: 4/23/2025
By: Audrey Hurtado, Joshua Faircloth, Avery Bouskila, and Evan Riojas
N
City of New Braunfels, Texas Parks & Wildlife, CONANP, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

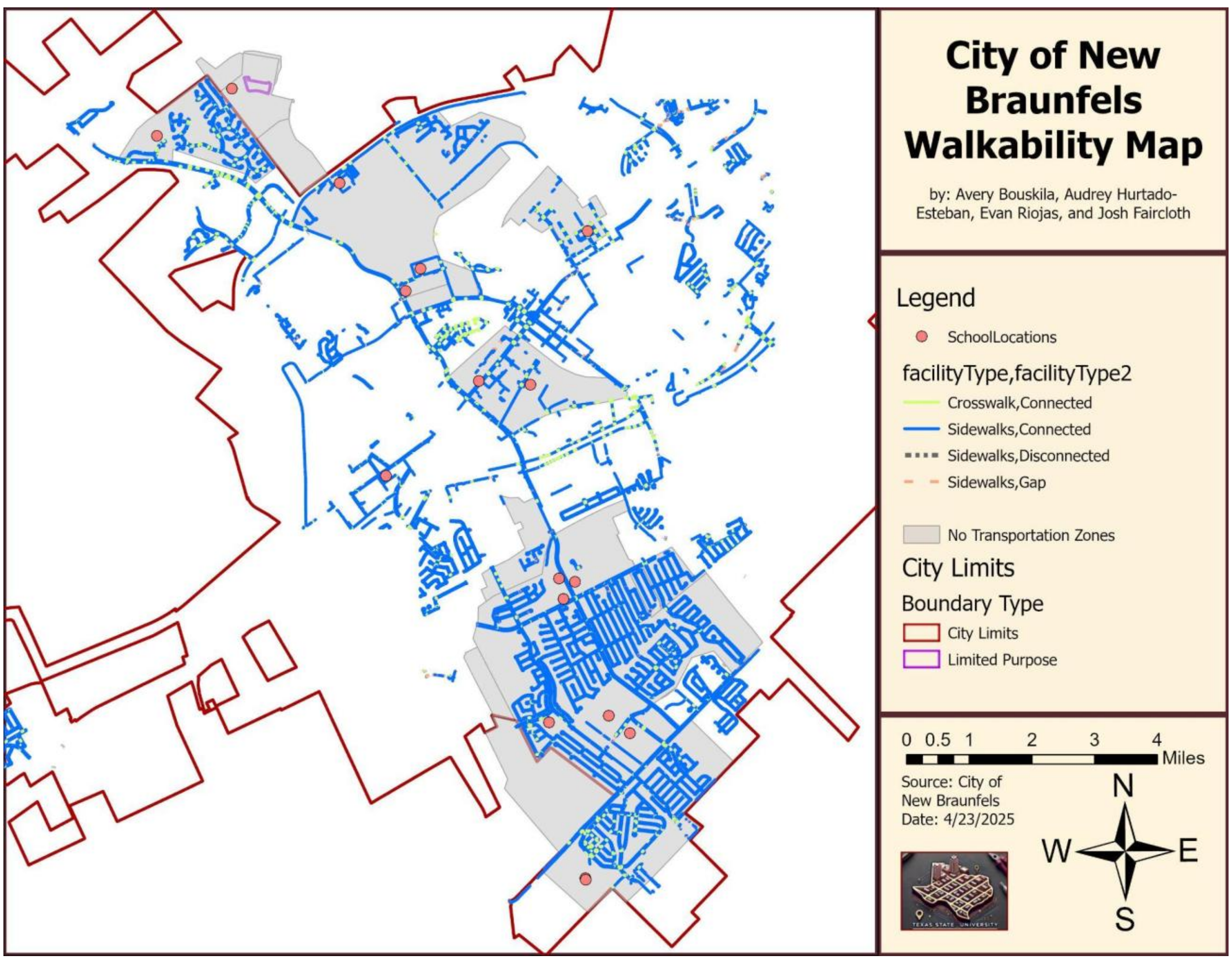


The Individual School Type Numerical Analysis conducted in New Braunfels revealed that older schools tend to be located in parts of the city platted and developed before modern sidewalk infrastructure standards were widely adopted or enforced. Consequently, these areas often feature a more piecemeal approach to sidewalk construction, resulting in gaps where sidewalks were never initially built or have deteriorated over time without consistent upgrades. Additionally, the original designs around older schools might not have prioritized pedestrian connectivity to the same extent as more recent developments, leading to more discontinuities and less comprehensive sidewalk networks in their vicinity. This was highlighted in multiple No Transport Zones, where schools had a general lack of sidewalks, while modern schools had better connectivity. This is especially seen in Carl Schurz Elementary School, where there were virtually no sidewalks leading to the highest need area. Veramendi Elementary School was excluded from the analysis since it is located outside of school limits.

c. Gaps and Disconnects

Disconnects were by far more common than gaps across the entire project area. There were 688 disconnects versus only 275 gaps. The total length of gaps was higher, disproportionately, than all gaps combined at 34,076 feet in combined gap length. Larger portions of gaps and disconnects were found in older, more established neighborhoods than in newer suburban neighborhoods. Higher density areas often coincided with the latter, younger suburban neighborhoods, whose populations are growing at an exponential rate comparatively.

d. Sidewalks and Crosswalks



The complete walkability framework provides a network of features that ideally should connect students to homes. Visually analyzing the walkability features it becomes more apparent where large numbers of disconnections are located and the schools that it surrounds.

Discussion

Our results were somewhat expected in the sense that older neighborhoods in the core of "old New Braunfels" have a higher density of gaps and disconnects than newer neighborhoods, more on the suburban outskirts. Many of these older neighborhoods were built before the advent of standardized ADA requirements for construction. It comes as no surprise that the school that has the highest amount of disconnects and gaps (as well as minimal sidewalks) is Carl Schurz Elementary School, found closer to downtown New Braunfels, where the connectivity problems are the greatest.

For general data quality issues, in the first week of the project, we did not have updated imagery, but this was quickly rectified by the City of New Braunfels GIS department which delivered the updated aerial imagery within the week. Accuracy of the data, besides this particular situation was superb and updated to the current modern timeframe. We were able to successfully digitize New Braunfels' pedestrian infrastructure, creating a complete database of sidewalks within the boundaries of the City of New Braunfels.

With this completed database of sidewalks within city limits, the City GIS Department can easily use our work as a basis for their five-year plan to bring existing sidewalks to full connectivity and ADA compliance. If more time were allotted to our group, we could have created a network of sidewalks and done a proper Network analysis to fully expand our results and understanding of said results.

Conclusion

This project provided a comprehensive evaluation of pedestrian infrastructure in the City of New Braunfels, with a focus on accessibility within student no-transport zones. Through high-resolution aerial imagery, detailed attribute classification, and systematic GIS digitization methods, our team successfully created a refined geodatabase of sidewalks, crosswalks, and connectivity issues such as gaps and disconnects. The data and analysis produced in this project form the foundation for the city’s five-year pedestrian infrastructure improvement plan, specifically aiming to enhance walkability for students and the broader community.

Our findings revealed critical spatial disparities in sidewalk infrastructure, particularly within older neighborhoods near the city center, where connectivity issues were most prevalent. This spatial trend underscores the urgent need for targeted investment in pedestrian improvements in legacy areas that were developed before modern accessibility standards.

Beyond its direct contributions to the city’s planning efforts, this project also provided invaluable hands-on experience for our team in real-world GIS workflows, including data management, spatial analysis, and quality control. The project’s success was made possible through close collaboration with the City of New Braunfels GIS department, whose support was instrumental throughout the process.

Ultimately, this project demonstrates the powerful role of GIS in addressing urban infrastructure challenges and highlights the importance of data-driven planning in promoting safer, more accessible, and more connected communities.

Appendix I: Group Member Contribution:

Avery Bouskila-

The primary role of a project manager is to keep track of assignments, progress, and general guidance. I also laid the framework for assignments and checked over everyone's work, which includes presentations, papers, and general checks when it came to digitization to make sure everyone is on the same page. I always wrote the introductions to lay out both the formatting and style of presentations/papers, and checked over group work to make sure that all aspects of the project were cohesive. I tried to foster a collaborative atmosphere when it came to troubleshooting, as everyone has different strengths. I did workflow management as well, and an example of this was a Google sheet with all the grids as checkboxes separated by group members to track overall progress. I had also created a Google Doc for us to add questions for our weekly meeting with the City of New Braunfels, to both document discrepancies and talk about challenges. I also completed my eight grids digitizing, documenting sidewalks, gaps, disconnects, and gaps. For this report, I handled the abstract, introduction, and part of the results for the school type numerical analysis. I also did the introduction, methods, and conclusion for the presentation and the whole poster, as I enjoy making posters.

Audrey Hurtado-

I did numerical analysis for every school level and created layouts for the final deliverables. These layouts were made in ArcGIS Pro. I digitized 9 grids in total and appended my grid successfully to my teammates' grids. For the final report, I wrote the conclusion and edited a couple of things throughout. I drew statistics from ArcGIS Pro layers to aid in my numerical analysis. I also did the numerical analysis portion for the presentation. I communicated as best as possible with my teammates to ensure quality and make sure we were on the same page.

Joshua Faircloth-

My role in the group was primarily supported through digitization work and writing assistance. If there was anything necessary to get done from baseline digitization to quality control, to assistance in analysis, I was there to lend a hand. My main task was the digitization of eight grids, which I completed. I tested the first append with Evan as well as numeric summarization analysis to make sure the system worked. The layout of the kernel density map was also created by me. I have also assisted in the writing of multiple presentations, proposals, and progress reports. I was behind the budget and timeline of the proposal, subtasks 2.1, 2.2, and 2.3 of the progress report, and parts of the appendix section of this document, as well as the data section of this document and the PowerPoint presentation. Everything in the analysis methods of this document, besides Kernel Analysis, was also written by me. I also wrote the discussion section of this document.

Evan Riojas-

My role was very broad, I contributed to the digitization of 8 grids. I developed the digitization methodology, kernel analysis methodology, and gave the fundamental structure to the numerical analysis methodology. I contributed our workflow and assisted the group in understanding how to accomplish the analysis. I was ultimately responsible for appending Josh and Audrey’s combined grids and Avery's grids to my grids to create the final product. I went over the entire grid conducting QA/QC. I completed our kernel analysis as well as our heatmap analysis. Overall, I was mainly responsible for creating our analysis portion and assisting the group in understanding the analysis portion.

Appendix II: Metadata

File Name	**Description**
fcWalkabilityEditing.lyrx	Layer to create new features
fcWalkabilityExisting.lyrx	Layer that contains old features
fcWalkabilityHSAnalysis.lyrx	Layer that shows all gaps and disconnects
fcWalkabilityGAPS.lyrx	Layer that contains exported gaps and disconnects from fcWalkabilityFINAL
fcWalkabilityFINAL.lyrx	Layer that contains the completed dataset of sidewalks, crosswalks, gaps, and disconnects
fcWalkabilityPOINT.lyrx	Layer that contains converted gap and disconnects into midpoint features
fcWalkabilityKERNEL.lyrx	Layer showing the exported gaps and disconnects from fcWalkabiltiyFINAL for conversion into raster file
KerneRASTER.tiff	Completed layer showing final product of gaps and disconnects using kernel analysis
ScoolLocations.lyrx	Layer showing all school locations
GridIndex.lyrx	Layer that splits the map into a grid system
SchoolNoTransportationZones.lyrx	Layer that contains polygons around school locations

ISDSchoolAttendance.lyrx	Layer that contains polygons depicting geographic areas of school attendance
Imagery/Orthoimagery.lyrx	Layer that shows aerial imagery of the City of New Braunfels
CoNB Layout.pagx	Layout file for kernel density map
Numeric Analysis Layouts Folder	Folder containing all layouts and maps of our numeric analysis

Appendix III: Additional Contacts and Resources for Information Collection

City of New Braunfels Team

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