**Cypress Cartographic Solutions**

**Project Proposal**

**February 2013**



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**Cartographic Modeling of Sidewalk Location Selection for**

**The City of San Marcos, Texas**

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**Prepared by**

**Cypress Cartographic Solutions**

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# Introduction

## Summary

San Marcos, Texas is a diverse and growing community. The city contains Texas State University, the outlet malls, beautiful natural features, and many other important landmarks, each providing a rich cultural identity to the city. Each of the features the city boasts provides a challenge in how members of the community access them. Many residents of San Marcos move throughout the city as pedestrians. Walking is affordable, convenient, healthy and should be a viable option for residents without access to other transportation options. San Marcos residents have expressed a desire for San Marcos to improve pedestrian-friendly infrastructure. The City of San Marcos is currently developing a new comprehensive plan, but has no defined criteria for locating sidewalks. Cypress Cartographic Solutions will work with The City of San Marcos to develop location criteria based on pedestrian traffic generators, such as schools, hospitals and shopping centers. These criteria will then be utilized in GIS to map potential locations for future sidewalk development as part of the new comprehensive plan. San Marcos is a place to be enjoyed; we hope to make it easier to do so.

## Purpose

 The purpose of this project is to create a model which will rank locations by their need for sidewalk infrastructure within San Marcos, Texas. The city is developing its new comprehensive plan, in which transportation will be an important component. Developing a methodology to locate new sidewalk development will help the City of San Marcos best utilize funds on areas most in need of pedestrian infrastructure. Research will be conducted regarding sidewalk development costs and types. The end product will include cost estimates for sidewalk development at numerous locations within the San Marcos City Limits.

##

## Scope

Our scope will be within the San Marcos city limits, with emphasis on areas near pedestrian traffic generators. Our model will be designed to be applied to the present, but also applicable to future development.

# Literature Review

A literature review was conducted during the creation of our project plan. Various studies have been published in which planners, city governments, and other researchers explore how to plan sidewalks. Within these studies we found trends in methods and ideas. This section will detail some of our findings in our literature review.

Sidewalk planning often involves ranking sites hierarchically based on nearby access needs. The relative importance of factors to be ranked is always subjective, but tailoring the ranking to the local needs is crucial. Ranking systems need to be easily understood, and comprehensive. (Pérez 2010, Zipf 2010) Factors should be selected to accurately portray the community and its needs. Access needs are diverse and plentiful throughout any community. Pedestrian access to businesses and retail centers can fortify the local economy by attracting citizens to conveniently visit these locations (Ehrenfeucht 2010, Loukaitou-Sideris 2010).

Site selection models often score individual locations by totaling ratings and weights in a summation. One study created a system which divided 100 points among factors deemed important to the location of sidewalks (Pérez 2010, Zipf 2010). This method allows for the ranking of factors according to relative importance, as well as hierarchical outputs based on score. Another study rated sidewalks in terms of safety and service, service being specified as ease of travel along a sidewalk path. Once sidewalk strips were rated, the model determined areas which needed development or improvement most (Town of Scituate Massachusetts Board of Selectmen, 2007).

It is difficult to determine precisely how sidewalks should be sited, as access needs are difficult to quantify. Sometimes knowledge of the cultural and economic situation within a community is most useful in determining what is needed (Town of Scituate Massachusetts Board of Selectmen, 2007). Throughout our project we are going to use our own experiences in San Marcos, paired with knowledge gained from past studies to develop our sidewalk siting model.

# METhodology

## Data

To create a model which can accurately select areas in need of new sidewalk development, we will need to collect and create data. Most of the necessary data has been provided by The City of San Marcos, but some will still need to be gathered. ArcGIS 10, Google Earth, and Microsoft office will be the software used for this project.

###

### Data: City of San Marcos

 City Facilities

 Schools

 Pedestrian CIP

 Railroads

 Sidewalk Inventory

 Street Centerlines

 Trails

 City Parks

 Texas State University

 Zoning

### Data: Acquired Online

 San Marcos City Limit (http://www.ci.san-marcos.tx.us/index.aspx?page=281)

### Data: To be Created

 Medical and Pharmacy Facilities

 Grocery Stores

 Retail Centers

 Public Transit Stops

 Low Income and Student Housing

## Methodology

 Our primary purpose is to develop a method and model for site selection of sidewalk development that will work presently and into the future. This section will detail our objectives in order to accomplish this task.

### Data Preparation

 To prepare data for processing, first we will need to create several new layers. These layers will contain locations and information regarding pedestrian traffic generators, such as pharmacies, grocery stores, and low-income housing. We have decided that due to the scale of our study, we will manually create data points and polygons for these places, rather than geocoding the addresses. Google Maps will be our primary method for finding and referencing traffic generator location, to then be manually added onto our map as features.

 Additionally we will need to create a layer that shows gaps in the sidewalk inventory, which inventories areas with no sidewalks by placing center points in the gaps of the present sidewalk inventory. Our site selection of areas in need of sidewalks will come from this layer. Sidewalk CIP projects will be omitted from this layer.

### Data Processing

 Beginning in the Model Builder interface of ArcGIS, all of our data will need to be edited to fit our scope. As mentioned previously, our scope is specifically all areas within the city limits of San Marcos, Texas. All sidewalks within areas of residential zoning will be omitted from our study.

 Additionally, we will create factor ratings and weights for the sidewalk. This will rank each criterion in importance, relative to its need for sidewalk access. Examples of factors are doctor offices, parks, and grocery stores while medical, schools and retail are examples of criteria factor ratings. Once factors are rated, criteria will be weighted as well. This way the system is hierarchical on multiple levels. Factors are more important than other factors, and some criteria will weigh more in our computations than others. The table below details our tentative ratings and weights for each factor and criteria.

 These factor ratings will then be associated with the sidewalk gap layer through the use of buffers. Each factor associated with a sidewalk gap point will then converted to its own layer in raster format to be used for our analysis.

|  |  |  |  |
| --- | --- | --- | --- |
| Criteria | Factor | Factor Rating | Weight Value |
| **City Facilities** | Activity Center | 9 | **1** |
| Public Library | 9 |
| City Hall | 7 |
| Municipal Building | 10 |
| Greenhouse Interpretive Center | 4 |
| Dunbar Recreation | 7 |
| Downtown Police Patrol | 2 |
| Conference Center | 7 |
| **Schools** | Elementary Schools | 10 | **2** |
| Middle Schools | 10 |
| High Schools | 8 |
| Private/Other Schools | 8 |
| **Trails/Parks** | Parks | 10 | **1** |
| Green space | 4 |
| Trailheads | 7 |
| **Transit** | Texas State University-San Marcos Trams | 8 | **1** |
| C.A.R.T.S. | 8 |
| **University** | Texas State University-San Marcos | 7 | **1** |
| **Medical** | Hospital | 10 | **2** |
| Pharmacy | 10 |
| Physicians/Other Medical Offices | 10 |
| **Retail** | Grocery | 10 | **1** |
| Retail Centers | 6 |
| **Low Income** | Low Income Housing | 8 | **1** |
| Student Living Areas | 8 |

###

### Data Analysis

 Continuing in the Model Builder Interface, our data inputs will have their factors rated, and each criterion will be weighted. A weighted sum will be calculated of the factor ratings and weights, followed by a weighted sum of average factor ratings for each criterion. This will give each location a score, which shows the need for sidewalks, depending on the nearby facilities and features. Once our model begins producing results with the desired information, we will begin to test the model certainty.

### Model Certainty Check

 In addition to developing our model, we will test its certainty and make adjustments to our data and methods to account for any discrepancies in our model’s performance. This will be done by running our model multiple times, each with different buffer radius lengths. Buffers with 50 meter, 100 meter, and 200 meter radii will be used to demonstrate model performance under differing parameters. This will give us multiple sets of results, from which we select the most reasonable. Depending on the data present at these locations, adjustments may need to be made to create a more accurate simulation of site selection.

# Implications

 The result of our project will be a model with which the City of San Marcos can identify potential sidewalk development sites. Sites will be ranked hierarchically based on the resulting scores of our model. The model will utilize current data, but will be able to change as data is updated in the future. An updated data layer will be able to be substituted in the place of an outdated data layer, thus modernizing the model. The model could potentially rule out sites before surveying begins, therefore lowering total cost for sidewalk planning.

# Final Deliverables

**At the conclusion of our project, The City of San Marcos will receive the following:**

 **Detailed Final Report, two copies**

 **Project Website**

 **CD, two copies containing:**

 **All data**

 **Metadata**

 **Proposal, Progress Report, and Final Report**

 **Poster**

 **PowerPoint Presentations**

 **Instructions on how to use the CD (*readme* file)**

 **A poster will be produced for the Texas State Geography Department.**

# Budget

|  |
| --- |
| **City of San Marcos, Sidewalk Proposal Budget** |
| Task | Assigned | Rate | Time Period | Total |
| Data Collection & Organization | 4 Consultants | $20/hr | 10 hrs/wk\*4 wks | $3,200.00 |
|   | Total | $3,200.00 |
| Data Analysis & GIS Design | 2 Analysts | $25/hr | 10 hrs/wk\*6 wks | $3,000.00 |
|   | 1 Assistant Mngr | $35/hr | 10 hrs/wk\*6 wks | $2,100.00 |
|   | 1 Project Mngr | $50/hr | 5 hrs/wk\*6 wks | $1,500.00 |
|   | Total | $6,600.00 |
| Project Management | 1 Assistant Mngr | $35/hr | 5 hrs/wk\*10 wks | $1,750.00 |
|   | 1 Project Mngr | $50/hr | 10 hrs/wk\*10 wks | $5,000.00 |
|   | Total | $6,750.00 |
| Equipment Costs | Supplies | $150/Workstation | 4 Workstations | $600.00 |
|   | Maintenance | $200/Workstation | 4 Workstations | $800.00 |
|   | Depreciation | $12,000(4 computers @ $3000) | 36(Life of Equipment in Months)\*2 months of use | $666.67 |
|   | ESRI Software License | $10,000/yr | 2 months of use | $1,666.67 |
|   | Total | $3,733.34 |
|   | **Grand Total** | **$20,283.34** |

# Timetable

| February |
| --- |
| M | T | W | T | F | S | S |
|  |  |  |  | 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 |  |  |  |

*Phase 1: Data Collection*

The first phase of the project will consist of reviewing available literature and collecting data. In order to best serve the City of San Marcos, Cypress Cartographic Solutions will research available information regarding sidewalk infrastructure in municipalities to give an accurate assessment of what the client’s funds may do. At this stage, we will sort through available data as well as create our own in order to develop our model.

*Phase 2: Data Processing*

In phase 2, we will begin to process our data for model development. All data will be converted to the proper format and all necessary transformations will be performed. Metadata will be checked to ensure accuracy.

*Phase 3: Data Analysis*

At phase 3, our criteria ranking and weight system will be integrated into a model. After running the model, we will examine results and reformat our model as necessary. Models will be tested for certainty to ensure quality.

*Phase 4: Data Interpretation*

Phase 4 will involve developing the visualizations of our model results. Maps will be produced which will detail segments along streets within San Marcos which scored high on our sidewalk site model. Our data will then be organized into our final deliverables and presented to our client.

February 20: Proposal Presentation

March 25: Progress Presentation

May 3: Final Product Delivered

| March |
| --- |
| M | T | W | T | F | S | S |
|  |  |  |  | 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 |
| --- |
| M | T | W | T | F | S | S |
| 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 |  |  |  |  |  |

| May |
| --- |
| M | T | W | T | F | S | S |
|  |  | 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 |  |  |

# Conclusions

 In conclusion, our project will develop a model to rank sidewalk development locations based on criteria such as schools and medical facilities. We will produce maps using our model results that will illustrate locations within the San Marcos city limits in need of sidewalks. Our model concept is based off of research done by others, as well as GIS suitability modeling. Our hope is that our project will provide a valuable resource for the City of San Marcos as pedestrian infrastructure developments are planned. Allocating funds to the areas in need of development most is critical, and we will endeavor to create as accurate and sensitive a model as possible.

# Participation

**Rachel Cavin, Manager:**

 Introduction, Conclusion, Quality Control and Editing.

**James Dodds, Assistant Manager:**

 Methodology, Implications and Editing.

**Taylor Dorn, GIS Analyst:**

 Literature Review, Graphic Design and Editing.

**Kyler McNew, GIS Analyst:**

 Budget, Timetable and Editing.

# References

City of Peterborough. 2008. *Sidewalk Strategic Plan: Phase 1-Sidewalks.* The city of Peterborough.

Coleman, V., T. Sufi. 2011. Development and Implementation of the City of Charlotte’s Sidewalk Retrofit Policy.

Ehrenfeucht, R., A. Loukaitou-Sideris. 2010. Planning Urban Sidewalks: Infrastructure, Daily Life and Destinations.” *Journal Of Urban Design* 15.4: 459-471. *Environment Complete*

Evans-Cowley J. Sidewalk planning and policies in small cities. Journal Of Urban Planning And Development.;132(2):71-75. Available from: Science Citation Index, Ipswich, MA.

HowMuchIsIt. 2010-2013. How Much Does Sidewalk Installation Cost? http://www.howmuchisit.org/sidewalk-installation-cost/ (Last accessed 7 February 2013)

Oliver-Solà, J. A. Josa, J. Rieradevall, X. Gabarrell. 2009. Environmental optimization of concrete sidewalks in urban areas. *The International Journal of Life Cycle Assessment* 14(4): 302-312

Pérez, C., M. Zipf. 2010 A Streamlined Approach to Prioritize Sidewalk Investments.

Town of Scituate Massachusetts Board of Selectmen. 2007. *Scituate Sidewalk Study Final Report.* The city of Scituate.