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## St. Thomas Aquinas Parking Ramp

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# St. Thomas Aquinas Parking Ramp

## **Problem Statement**

Saint Thomas Aquinas Parish in Ames, Iowa added a two-level parking structure in fall 2012 to allow for more parking for parishioners (<http://staparish.net/>). The lower level has 78 parking spaces and the upper level has 94 parking spaces. To access the lower level, there is an entrance on Lynn Avenue. To access the upper level, there is one entrance on Ash Avenue. The parking structure has allowed more parishioners to park and attend services, but there are still not enough parking spots for everyone. Currently, there are no control devices limiting who can and cannot park there, a dead end on the top level, and no way to effectively communicate when the lot is full. Parishioners are allowed to park in the Memorial Union Parking Ramp for free. Parishioners waste valuable time looking for a parking spot in the parking structure if it is full.

## **Disciplines**

Bioresource and Agricultural Engineering | Industrial Technology

# IOWA STATE UNIVERSITY

Department of Agricultural and Biosystems Engineering (ABE)

TSM 416 Technology Capstone Project

## St. Thomas Aquinas Parking Ramp

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**Client:** St. Thomas Aquinas Parish, 2210 Lincoln Way, Ames, Iowa, 50014, [www.staparish.net](http://www.staparish.net)

- Contact(s): Bobby LeBlanc, Business Manager, [bobby@staparish.net](mailto:bobby@staparish.net), 515-292-3810; Carl Bern, Dept. of Agricultural and Biosystems Engineering, ISU, [cjbern@iastate.edu](mailto:cjbern@iastate.edu), 515-294-1270

## 1 PROBLEM STATEMENT

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### Problem Statement

- *Saint Thomas Aquinas Parish in Ames, Iowa added a two-level parking structure in fall 2012 to allow for more parking for parishioners (<http://staparish.net/>). The lower level has 78 parking spaces and the upper level has 94 parking spaces. To access the lower level, there is an entrance on Lynn Avenue. To access the upper level, there is one entrance on Ash Avenue*
- *The parking structure has allowed more parishioners to park and attend services, but there are still not enough parking spots for everyone. Currently, there are no control devices limiting who can and cannot park there, a dead end on the top level, and no way to effectively communicate when the lot is full.*

- *Parishioners are allowed to park in the Memorial Union Parking Ramp for free. Parishioners waste valuable time looking for a parking spot in the parking structure if it is full.*

### **Business Case Statement**

- A. **What:** *An effective way to communicate when the lot is full and what to do in that situation. Optimizing traffic flow in and out of the parking ramp, particularly the upper level.*
- B. **How:** *The traffic gets congested when the late arrivals pull into the lot looking for a spot and there isn't an effective way to turn around at the end of the parking structure. There is only one entrance for both levels but the lower level flows much better than the upper level. There is unauthorized use of the parking spaces.*
- C. **When and Where:** *Particularly problems occur before and between masses on Sundays. It mostly takes place on the upper level of the parking ramp.*
- D. **Why:** *Establishing a better parking system is important in saving the community time and the frustration when going to Sunday mass.*
- E. **Who:** *Church attendees and parishioners will benefit from these alterations.*

## **2 GOAL STATEMENT**

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- **Main Objective(s) and Specific Objectives**
  - **The main objective is to:** *Develop a system that provides parishioners a more efficient parking facility, with minimal flow issues.*
  - **Specific objectives include:**
  - *Analyzing the parking structure and provide suggested solutions to:*
    - *Inform users when the lot is full.*
    - *Prevent unauthorized parking.*
    - *Prevent the bottleneck on the top level of the facility where there is no turnaround.*
  - *Inform users when the lot is full:*
    - *Account for handicap spots.*
    - *Accurate so people can trust the system.*
    - *Also, provide additional parking information. Additional parking is available at the Memorial Union parking garage.*
  - *Prevent unauthorized parking:*
    - *Cannot slow down the flow of traffic, especially during the busy hours on Sundays.*
    - *People who are allowed to park in the ramp need to be able to access the ramp.*
  - *Alleviate the bottleneck on the top level of the facility:*
    - *We cannot lose a large number of parking spots.*
    - *We have to keep the handicap parking spots.*

- **Rationale**

- *Reduce the stress and frustration of parishioners while they park.*
- *Save turn-around time of at least two minutes with lot full display.*
- *Monitor the facility more effectively without having to walk through.*

## 3 PROJECT PLAN/OUTLINE

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### A. Methods/Approach

- **Reference Material(s)**
  - *Parking facility blueprints provided by St. Thomas Parish.*
  - *Design and Layout software such as ParkCAD and AutoTurn.*
  - *Previous ideas pitched to St. Thomas Parish by the construction company that built the garage – given to us by St. Thomas Parish.*
  - *We also used company websites to perform research on various solutions to the problems.*
- **Data collection:**
  - *By observing the parking garage on multiple Sundays before mass we saw the problem areas that we have already established.*
- **Skills:**
  - *We need to understand what the critical issue that is causing such a bottleneck in the parking garage, is it no lot full sign, is it that people are parking there that shouldn't be, is it that the top level has a dead end, or more likely is it a combination of all three?*
  - *In TSM 444 Facility Planning and Management, we learned about parking facilities and material flow if we assume cars are materials on a factory floor we can turn the problem into a Facility Planning and Management one.*
- **Solutions:**
  - *We built a matrix using what we believed to be important criteria. Our matrix included costs, flow effect, lot full accuracy, security, the number of spots lost, and the number of people needed.*
  - *The matrix was approved by the St. Thomas Building and Grounds Board.*
  - *Proposed solutions were rated on how well they can accomplish one of three things: eliminate unauthorized parking, inform users that the lot is full and where they can park, and how well it reduces the bottleneck on the top level of the parking facility.*
  - *The proposed solutions are consistent with the objectives of the scope as well as meet the client's expectations by resolving the three main issues, making the parking facility more efficient.*
- **Organization:**
  - *We brainstormed each of the three outlined problems for a week individually, then we came together and discussed what we found, during that discussion we narrowed the solutions down to two or three finalists. We then*

*researched those finalists and rated them on our matrix to determine the different solutions.*

- *We met with our client once, but have been in contact with them throughout the process to help answer questions. We also attended the building and grounds board meeting to get feedback.*
- *We scheduled our research and matrix to be completed on March 17th this allowed for ample time to complete the deliverables for TSM 416 and allowed for setbacks that come with working with a real client.*

#### **B. Results/Deliverables**

- *Our deliverable is a report and presentation listing our proposed solutions and the pros and cons associated with each.*
- *The deliverables were completed by April 14<sup>th</sup>.*
- *Our project was completed as planned and our recommendations are to first move forward with installing the Parking Logix System. Next, we recommend implementing cameras as well as using stickers/permits. Lastly, repainting the parking stalls in a new layout.*
- *The next step is to contact Parking Logix to acquire the new system, as well as figure out a date to self-install.*
- *After that is installation. This should not take more than a day.*
- *Once the system is setup, it can be monitored and modified to fit the church needs.*

#### **C. Timeline**

- *15 January – Observed the parking facility.*
- *02 February– Placed our final solutions to communicate when the lot is full and what other parking options were into our matrix to determine the best solution.*
- *16 February – Placed final solutions to fix the bottleneck on the top level of the parking structure into the matrix to determine the best solution.*
- *02 March – Placed final solutions to prevent unauthorized parking into the matrix to determine the best solution.*
- *17 March – Finalized solutions and narrowed down the ones we presented on.*
- *18 March – Started report and presentation.*
- *14 April – Finished report and presentation.*

## **4 BROADER OPPORTUNITY STATEMENT**

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- A. *The project mainly appeals to the St. Thomas Aquinas church attendees; it is a common goal that can be understood by church goers searching for parking spots or notifies them when the lot is full.*
- B. *In a small way, the parking ramp project improves communities by eliminating a stressful and frustrating environment for people trying to attend mass. It also communicates alternative parking when the lot is at capacity lessening the backup of traffic.*
- C. *This may become useful for other churches, schools, or businesses with similar parking problems. It may be used in many different situations to improve overflow.*

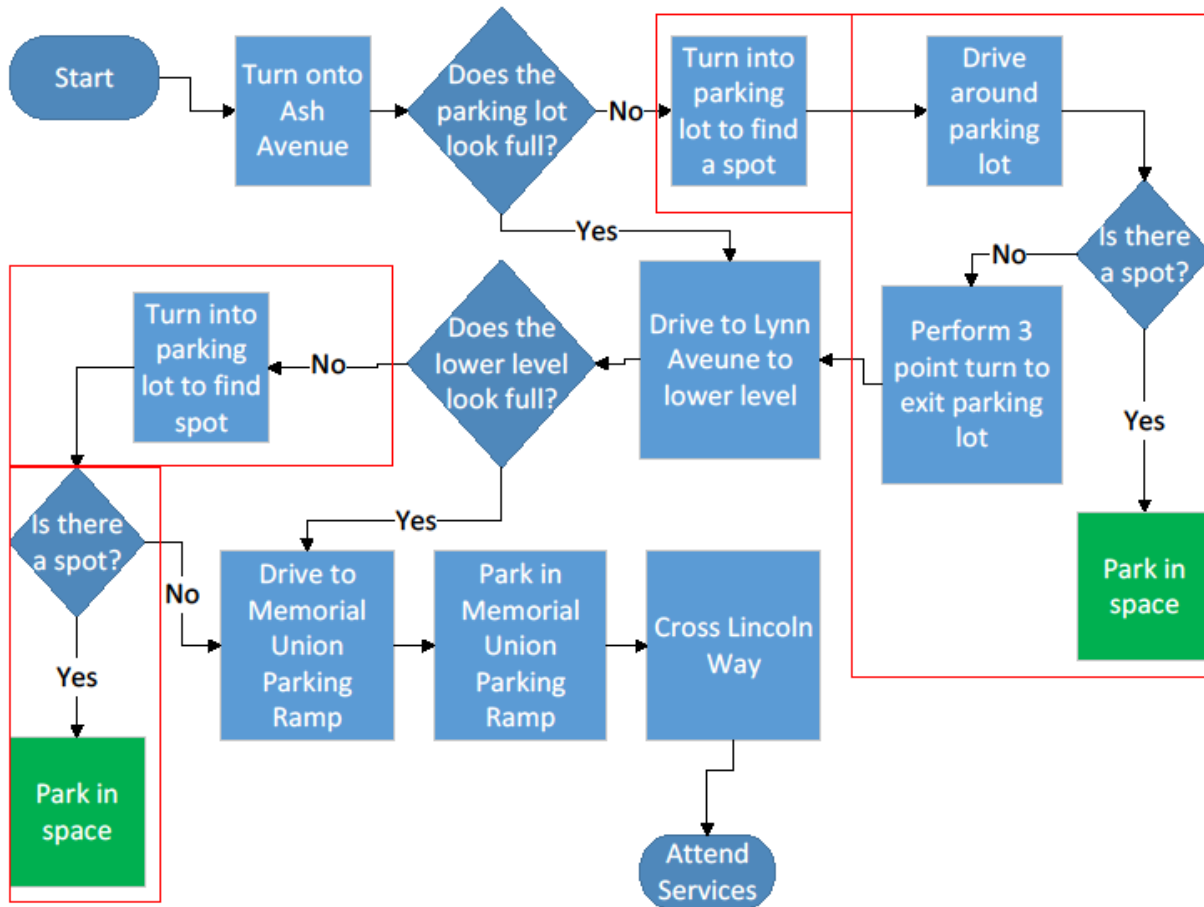
- D. Although this project will not generate income, it will still benefit the church with happier attendees and a less cluttered parking area. When the plan is implemented mass attendees should see results quickly.*

## 5 PROJECT SCOPE

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- A. The bounds for this project included monitoring, researching, designing, and concluding the best possible solution for the overflow and communication of the parking ramp.*
- B. The particular sector of the church we were focused on was only the parking ramp to control overflow in the best way that we could.*
- C. There were some parts of St. Thomas Aquinas that were not included in our project, such as the church itself, and the services it offers. It was strictly a parking issue.*
- D. Changing the parking ramp structurally was out of our bounds, due to the simple fact that it was so costly. It was also undesired by our client.*
- E. It would have been an easy fix to redesign the entire parking ramp with exits on both ends, but that just wasn't in the budget or realistic.*

## 6 GRAPHICAL ABSTRACT



## 7 APPENDIXES

1. **Parking Logix**
  - 1.1. **System Description**
  - 1.2. **Decision Matrix**
  - 1.3. **Mock Up**
  
2. **RedStorm System**
  - 2.1. **System Description**
  - 2.2. **Decision Matrix**
  
3. **Manual Worker**
  - 3.1. **System Description**



**3.2. Decision Matrix**

**4. Legacy Project**

**4.1. System Description**

**5. Repainting**

**5.1. System Description**

**5.2. New Layouts/Designs**

**5.3. Decision Matrix**

**6. Security Cameras**

**6.1. System Description**

**6.2. Decision Matrix**

**7. Stickers/ Hanging Permits**

**7.1. System Description**

**7.2. Decision Matrix**

**8. LiftMaster Gate**

**8.1. System Description**

**8.2. Decision Matrix**

## Appendix 1.1

### Parking Logix System

Includes:

- OpenSpace Pro Management Software
- 1 Tablet or Laptop PC
- 2 Solar Powered Signs
- 4 Parking Sensors and needed installation equipment (2 in counters and 2 out counters)

People Needed to Work

- One time self-Installation within hours
- Self-running and can be monitored from a PC

Flow

- Limits the number of cars that will enter the lot after it is full to keep the issues regarding the dead end at a minimum

Lot Full Information and Accuracy

- More accurate than traditional counters
- Uses magnets to count cars in and out, either embedded in the concrete or bolted to the driving surface
- Provides a readout on a digital sign of available spots left or when the lot is at capacity
- System provides a report of when cars enter and exit

## Appendix 1.2

### Parking Logix Decision Matrix

<b>Numeric Value</b>	<b>Flow 30%</b>	<b>Lot Full - Accuracy 30%</b>	<b>Security 15%</b>	<b>Number of Spots 10%</b>	<b>Number of People Needed 10%</b>	<b>Cost 5%</b>
1 Worst	Tertiary Effect	Only Displays when the lot is Full; Human Error	Tertiary Effect	5+ Stalls Lost	Workers Every Week	Most Expensive
3	Secondary Effect	Displays Spots Left; Human Error	Secondary Effect	0-5 Stalls Lost	Workers Needed Monthly	Middle Cost
5 Best	Directly Solves	Displays Spots Left; Little or No Error	Directly Solves	0 Stalls Lost or Stalls Gained	No Workers Needed or One Time Installation	Least Expensive

## Appendix 1.3

### Parking Logix Mock-Up



VMS is affixed to poles at site entrances indicating spaces available in Zone 1. They are mounted on 12 ft U channel with solar panel on top.



Sensor humps are drilled down at entry and exit points to count car traffic.



Lane delineators are recommended to separate incoming and outgoing traffic to ensure accurate counting



## Appendix 2.1

### RedStorm System

Includes:

- RedStorm Master Controller and Software
- 2 Remote Differential Counter
- 2 Signs
- DOES NOT INCLUDE INSTALLATION

People Needed to Work

- One time installation, but need an outside company to install
- Self-running and can monitor from a PC

Flow

- Limits the number of cars that will enter the lot after it is full to keep the issues regarding the dead end at a minimum

Lot Full Information and Accuracy

- Uses "Anti-tailgating Sensor Technology"
- Uses an infra-red overhead sensor to count the cars in and out
- System provides a report of when cars enter and exit

## Appendix 2.2

### RedStorm Decision Matrix

<b>Numeric Value</b>	<b>Flow 30%</b>	<b>Lot Full - Accuracy 30%</b>	<b>Security 15%</b>	<b>Number of Spots 10%</b>	<b>Number of People Needed 10%</b>	<b>Cost 5%</b>
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## Appendix 3.1

### Manual Counter System

Includes:

- Two handheld counters
- Two lot full signs
- Assuming you secure volunteers

People Needed to Work

- Two weekly volunteers
- Could pay for workers
- \$10/hr from 8:00 – 12:00
- Two workers \$80/week

Flow

- Limits the number of cars that will enter the lot after it is full to keep the issues regarding the dead end at a minimum

Lot Full Information and Accuracy

- Human error would cause the count to get off occasionally
- Workers would have to walk through the lot before starting
- The church could very well use this system in the short term however, it becomes harder to secure volunteers over time
- No ability to gain a report about the lot use

## Appendix 3.2

### Manual Counter Decision Matrix

<b>Numeric Value</b>	<b>Flow 30%</b>	<b>Lot Full - Accuracy 30%</b>	<b>Security 15%</b>	<b>Number of Spots 10%</b>	<b>Number of People Needed 10%</b>	<b>Cost 5%</b>
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## Appendix 4.1

### Legacy Project

Would Include:

- Counters used in automation systems
- Pressure Strips
- PLCs (Programmable Logic Controllers)

People Needed to Work

- Would require a new capstone group to design a counting system
- At least a year before implementation or results

Flow

- Limits the number of cars that will enter the lot after it is full to keep the issues regarding the dead end at a minimum

Lot Full Information and Accuracy

- While we feel confident students in our curriculum could create a system that will work, it is a large task for a group to implement
- You lose tech support when the group graduates

## Appendix 5.1

### Repainting

Includes:

- Stripping old stall lines
- New design layout
- Repaint new stalls

People Needed to Work

- One time stripping and repainting crew
- Cannot be used for 24 hours

Number of Spots

- 13 stalls lost with new layout

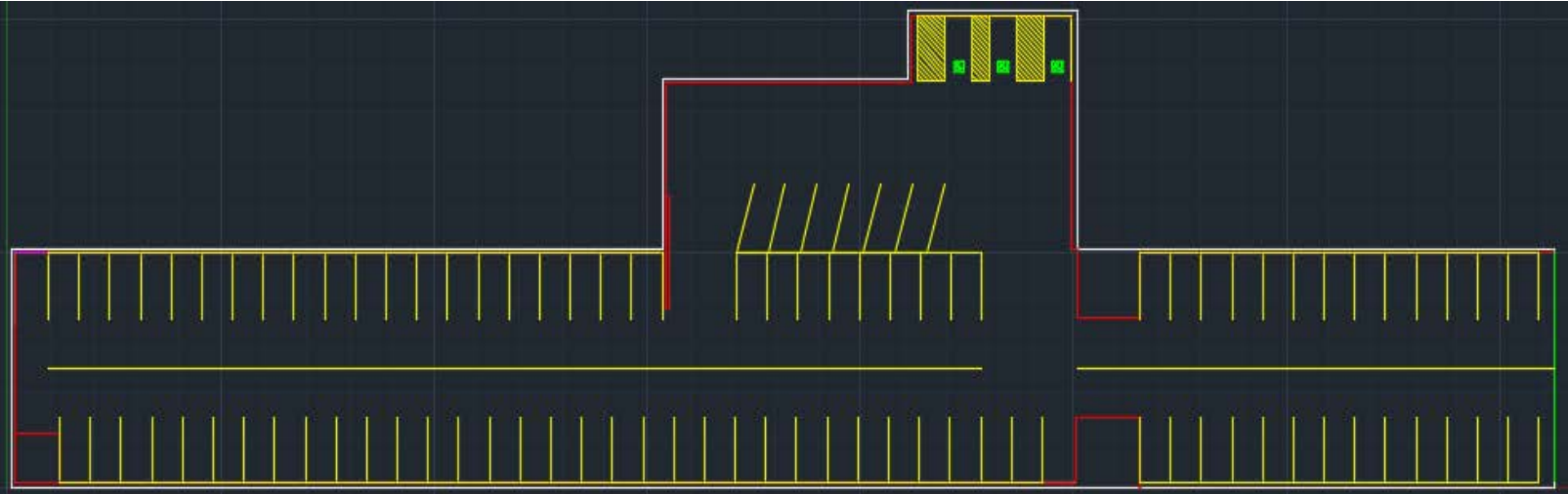
Flow

- Repainting would eliminate the dead end
- Provides an efficient turnaround

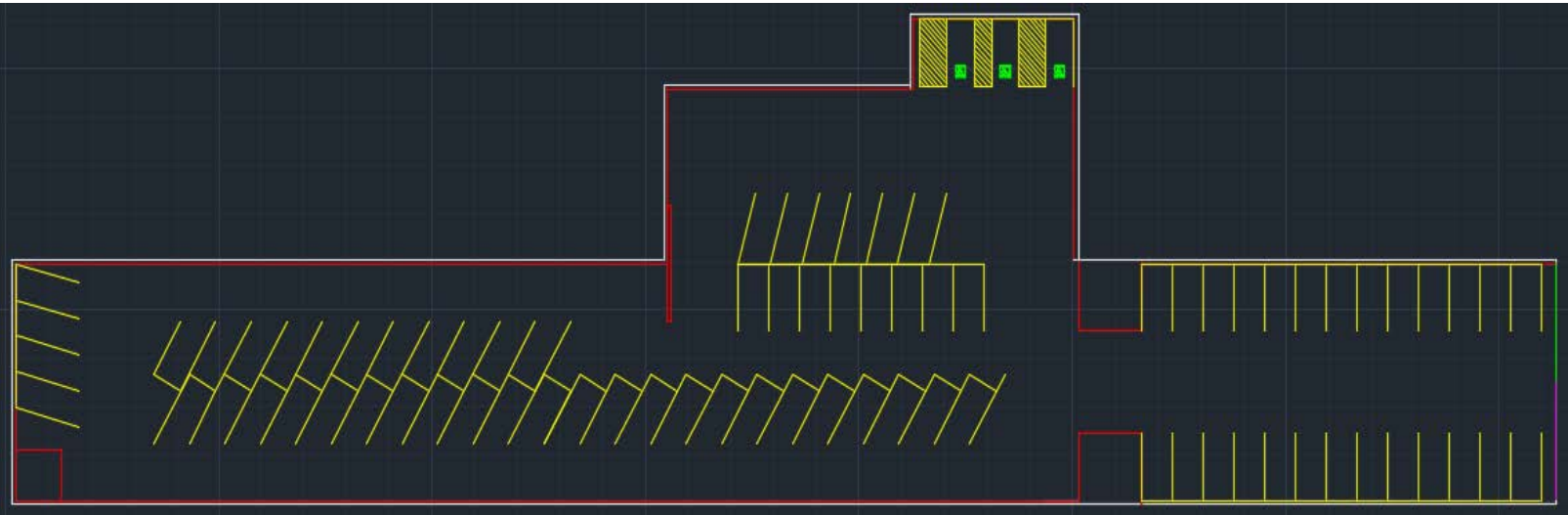
## Appendix 5.2

### Repaint Layouts/Design

Before (Current Layout)



After (New Layout)



## Appendix 5.3

### Repainting Decision Matrix

<b>Numeric Value</b>	<b>Flow 30%</b>	<b>Lot Full - Accuracy 30%</b>	<b>Security 15%</b>	<b>Number of Spots 10%</b>	<b>Number of People Needed 10%</b>	<b>Cost 5%</b>
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## Appendix 6.1

### Security Cameras

#### People Needed to Work

- Someone would still need to monitor video feed
- Makes it far easier to identify cars that should not be there

#### Security

- Deters illegal parking
- Advantage of viewing lot without physically having to walk through and monitor
- Easily watch for unauthorized parking
- Cameras also can be helpful for other monitoring aspects such as vandalism and other safety concerns

## Appendix 6.2

### Security Camera Decision Matrix

<b>Numeric Value</b>	<b>Flow 30%</b>	<b>Lot Full - Accuracy 30%</b>	<b>Security 15%</b>	<b>Number of Spots 10%</b>	<b>Number of People Needed 10%</b>	<b>Cost 5%</b>
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5 Best	Directly Solves	Displays Spots Left; Little or No Error	Directly Solves	0 Stalls Lost or Stalls Gained	No Workers Needed or One Time Installation	Least Expensive

## Appendix 7.1

### Stickers and Mirror Hung Permits

#### People Needed to Work

- Someone would still need to monitor passes
- Makes it far easier to identify cars that should not be there

#### Security

- Stickers are fixed and could be given to anyone at the church, but could lead to abuse
- Mirror hung permits would require everyone to come into the church and check in reducing abuse
- Easily watch for unauthorized parking
- Deters illegal parking

## Appendix 7.2

### Stickers and Mirror Hung Permits Decision Matrix

<b>Numeric Value</b>	<b>Flow 30%</b>	<b>Lot Full - Accuracy 30%</b>	<b>Security 15%</b>	<b>Number of Spots 10%</b>	<b>Number of People Needed 10%</b>	<b>Cost 5%</b>
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5 Best	Directly Solves	Displays Spots Left; Little or No Error	Directly Solves	0 Stalls Lost or Stalls Gained	No Workers Needed or One Time Installation	Least Expensive



## Appendix 8.1

### LiftMaster Gate System

Includes:

- Two mega arm tower barriers
- Four in/out keypad readers
- Safety photo-eye
- Includes installation

People Needed to Work

- Gate would run itself, people would just need a code to enter in
- One time installation, typically takes one day

Security

- Anybody without the code would not physically be able to access the lots
- Can control exactly who has access to the lot

Flow

- Every car having to stop to enter a code at the gate would cause a huge flow backup
- Churches are supposed to be welcoming, a gate typically keeps people out
- The flow resulting would be detrimental to the larger problems

## Appendix 8.2

### LiftMaster Gate Decision Matrix

Numeric Value	Flow 30%	Lot Full - Accuracy 30%	Security 15%	Number of Spots 10%	Number of People Needed 10%	Cost 5%
1 Worst	Tertiary Effect	Only Displays when the lot is Full; Human Error	Tertiary Effect	5+ Stalls Lost	Workers Every Week	Most Expensive
3	Secondary Effect	Displays Spots Left; Human Error	Secondary Effect	0-5 Stalls Lost	Workers Needed Monthly	Middle Cost
5 Best	Directly <b>FAILS</b>	Displays Spots Left; Little or No Error	Directly Solves	0 Stalls Lost or Stalls Gained	No Workers Needed or One Time Installation	Least Expensive