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Inventory Control System

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Formal Report

ENGR-4381/2

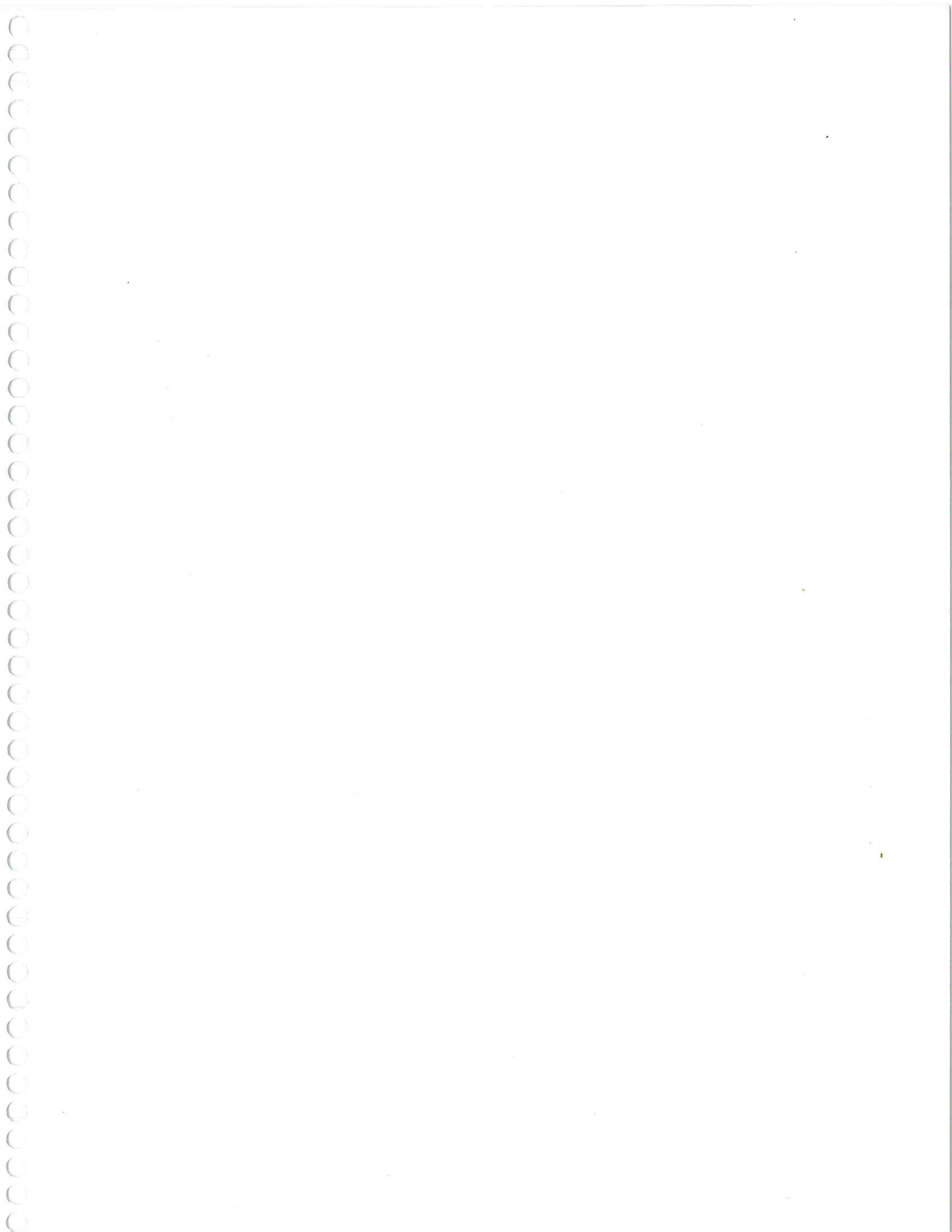
4/27/2010

Inventory Control System

M. Breitweiser, M. Jameson, S. Hill, E. Sheline, J. Stine
Dr. Giolma, Advisor



This report explains the paper inventory control system designed and developed for Venetian Marble and Granite. The system implements new methods in generating work orders, new labels for the marble pieces, new clipboard stations for tracking, new storage rack numbering, and Microsoft Access as the foundation to the entire system. The group highly recommends that Venetian integrates the paper inventory control system into their company as soon as possible in order to reap its benefits.



Executive Summary

Venetian Marble and Granite is a local countertop manufacturing and installation company that has an outdated inventory control system. The company has given the design group the opportunity to design and implement a brand new system at their facility in Helotes, Texas.

The group spent numerous hours studying and coordinating with various experts in the fields of radio-frequency identification, barcode identification, and paper identification as methods for tracking inventory. Through simplicity, efficiency, cost-analysis, and ease of implementation, the group decided a paper inventory control system would benefit Venetian the most. The paper system will integrate into their facility and current methods of manufacturing and tracking with the greatest ease.

The new system is a hybrid inventory tracking system. The company will implement paper and label tracking along with electronic tracking through an efficient electronic database. The paper inventory system will consist of a new method of generating a work order, a new work order numbering system, new labels to be placed on the manufactured pieces, clipboards located at specific locations in the manufacturing process, a new labeling system for the storage racks, and Microsoft Access. Microsoft Access is the foundation of the new inventory control system. Through Microsoft Access, the company will be able to eliminate their outdated tracking and inventory software (Q & A), record and track inventory, and generate pertinent reports vital to the operations of the company and the tracking of the marble pieces.

The group believes that the implementation of this simple, yet effective system will streamline the company's tracking efforts. By doing so, Venetian will inherently utilize their resources to their greatest extent. All pieces will be accounted for throughout the manufacturing and installation preparation stages. This system will integrate into the company's procedures and methods followed closely by their current employees. Integration of the system will be dependent on how quickly Venetian wants to restructure their inventory and tracking efforts.

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1 Introduction

In a commercial setting, radio frequency identification (RFID) and barcode identification provide for superior record and inventory tracking methods. However, smaller businesses do not have the expertise or the financial means to implement such costly systems. Venetian is the perfect example of a small-scale company looking to implement an effective system, but not at the risk of financial trouble. Furthermore, Venetian recognizes and understands the fact that simple and older technology can still have an enormous positive impact on the overall productivity of the company as a whole. From this observation, the paper inventory control system appeals more to Venetian's needs rather than the costly RFID and barcode systems. To implement a RFID or barcode system, the company would have to spend thousands of dollars and completely alter the routines of their workers. The paper system will be an inexpensive alternative that provides for great potential and will accommodate all of Venetian's tracking needs. The system has several new components and methods compared to Venetian's old inventory system. The old work order number has been revamped, the inventory software has been replaced, the old tracking methods have been redone, and the storage racks have been relabeled. The success of this system relies on Venetian's willingness to switch from their old system to the new system. Furthermore, utilizing each component of the new system will also factor into the overall effectiveness of this solution.

2 Design Description

A new, six digit numbering scheme for work orders is used in the new database, which will restart one time at the beginning of every calendar year. It is in the format of 'YY - _ _ _ _' where the first two digits are the last digits of the year (so 2010 would be simply '10') and the last four digits correspond to the number of work orders generated in that year (so the first work order generated in any year is '0001'). An example would be '10-0020', this work order is the twentieth work order generated in the year 2010.

Using Microsoft Access, a user friendly inventory database has been created. This new database has the ability to add new records, duplicate records, search for records, and input everything usually on a paper work order into the system electronically. The database will also have the capability to generate daily reports based upon delivery driver reports, daily pounds poured, and driver commission.

The sheets of paper that usually follow each piece throughout the manufacturing process will be replaced with a sticker that will be affixed to the bottom of each piece when it is cured, but before it is de-molded. These stickers will be generated when the inventory is added into the electronic database. The stickers come on a large roll from the company ULINE and all should be filled out by either the floor manager or one of the secretaries and kept together. Each sticker will have a blank for the work order number, the piece number in the work order, the color of the piece, and a schematic of the piece. Examples of each type of sticker can be found in Appendix E.

Assumed background

The clipboards at the areas of production of pouring, finishing, and storage will be used in a different capacity. Each "station" will now have a check in/out clipboard that each piece must be checked into and out of through production. An example entry is shown in Table 1.

Table 1: Clipboard Example

Work Order #	Piece #/ total	Date In	Initials	Date Out	Initials	Mixed/Poured by	Finished by	Location
--------------	----------------	---------	----------	----------	----------	-----------------	-------------	----------

The example above also shows an entry for location, this column will only be used when the pieces are put in the storage racks before leaving the facility. At the conclusion of business each day, the clipboards will be collected by David (the floor manager) for updating the inventory database, it is therefore very important to update these clipboards as specified. A new continuous indexing system will be provided for Venetian's current storage racks.

From initial meetings with Venetian management, the following project objectives were agreed upon for the group's project charter:

- provide a simple and maintainable electronic inventory database for the synthetic marble in the factory with information included on the current work orders and account for multiple pieces attached to a single work order
- supply a means to track all pieces through the manufacturing pieces through manufacturing, storage, and loading
- mark each piece with a unique identifier linking it to the electronic database
- begin tracking each piece as early in the manufacturing process as possible

Overall, the project goals were met. The goals that were not met and had to be revised in the final product was no tracking system that linked to the electronic database, and not being able to track the pieces in the factory before they had dried.

3 Methods

The labels that are affixed to the bottom of each piece during manufacturing are available in two different adhesive types: permanent and temporary. The group desired to test which would be best suited for Venetian's use. The group decided that the option to remove the labels for record keeping purposes should be included, but it is important that the labels stay affixed to the pieces during manufacturing. This was tested by affixing a sample label of each type to a sample of marble that was provided by Venetian and the 'stickiness' was checked periodically over the period of a month.

It was also decided that a new numbering scheme for the racks that store finished pieces should be devised and clearly labeled. This would provide uniformity for entering them into the database, as well as increase organization to streamline storage and shipment of the pieces. Each rack was given a letter A through P and those that had individual slots were numbered starting from one. The large rack located along the wall was labeled 'W'. Numbers and letters were created in MS Word, then cut out, laminated and stapled to the racks on the production floor.

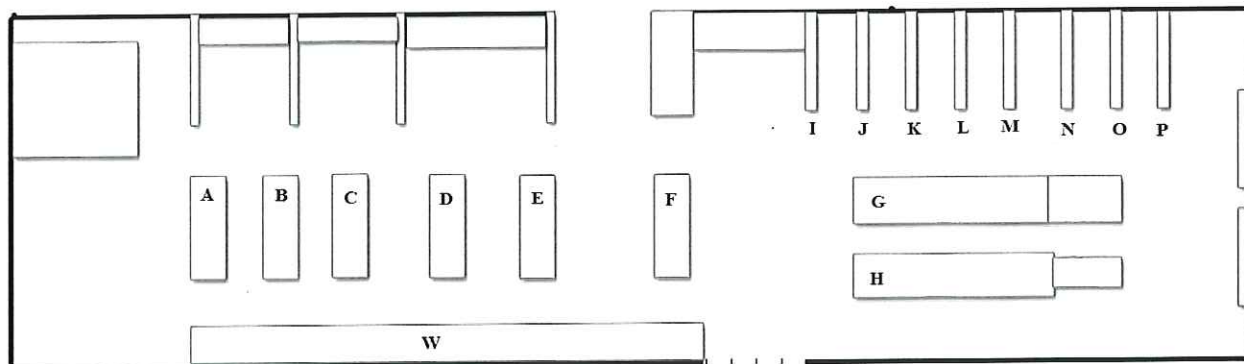


Figure 1: Implemented Rack Numbering Scheme

The database software we chose to implement for Venetian was Microsoft Access. The group decided that it would be best because it is a fairly universal; also updates are available for free from Microsoft, so the software will not become obsolete after the completion of our project. There are also online and print resources available for access so that features could be added easily based on the client's need.

The methods used to evaluate the performance of our initial design were simply to gather feedback from people that had been working with it, mainly David, the floor manager. The groups installed the first version of access on the computer on the production floor on March 25th. David then provided the group with feedback two weeks later on April 8th. The changes that were made included adding a report for “daily pounds”, which allows the user to see the total weight of countertops poured for any day, as well as an itemized list of each piece and its individual weight. It is important to include this in the database, because billing is based on how many pounds each piece weighs, as well as keeping track of raw inventory for supply ordering purposes. Forms for searching for billing dates were also added; this allowed users to enter a date and all work orders that were scheduled to be billed after that date or had yet to be assigned a billing date are itemized. Also included were fields for piece description such as an exhaustive menu of the possible colors that a customer could request. The user manual was also augmented to include directions for basic editing of the database. Key parts of the Microsoft user manual were also referenced to make editing the database easier.

4 Results

For the label test, it was determined that the best type of label to use was the one with the permanent adhesive. Because of the dust material on the sample piece, the removable label tended to come un-stuck around the edges after several weeks while the permanent label kept its hold. The permanent label also came off easily without leaving any residue.

Many small tests of the functionality of the database were run concurrent with the database's creation. Anytime a new report was added it was tested with different input values to see how robustly it worked and if it crashed. Testing was run on the reports covering work order search, daily pounds poured, driver commission, pounds per day for a date range, and the undelivered orders report. For the daily pounds, pounds per day, and undelivered orders reports different formats of date were entered, with Access recognizing all of the common ways of writing dates. Examples of the date formats are: 1 January 2010; 1-1-10; 1-1; 1st January; etc. All of these were accepted, with Access assuming the current year when year was not specified. Tests on the other reports revealed that with valid information entered, such as a driver's name for the driver commission report, the report displayed the correct information. When incorrect or invalid information was entered the reports would simply display empty reports rather than crashing.

Aside from the many small tests run concurrent with the creation of the database Venetian also tested the database and provided feedback from their tests. Feedback mainly involved adding more data fields to the database, such as fields for customer address and billing date. Other feedback involved creating two of the reports discussed above: undelivered orders and pounds per day.

All of this testing was designed to make sure the final database worked as the original design specifications said it should. It was shown through testing that the database was able to store all the information required by the charter such as color, dimensions, and location in facility. Testing and feedback from the manager at Venetian, David, also suggested that indeed the system provided a simpler means of tracking than the current paper based system. It was also shown that the database is capable of tracking multiple pieces in a single work order and multiple work orders without issue.

5 Conclusions and Recommendations

Our design accomplished our main objectives. We have implemented an inventory control system at Venetian. The workers do not have to make a huge change in their routine. We also were able to make the system work for under the budget. The system is not as automatic as it could be if barcode or RFID had been used, but this option would have put the project over budget.

This design can easily be expanded and we would recommend that in the future, Venetian should switch all of its employees over to using the Access database. One computer could serve as the host so that multiple computers at Venetian can access and modify data. The system they are currently using is inefficient and preventing them from reaching their full potential.

If Venetian were to expand its production, it would be beneficial to integrate barcodes into their labels and into access. There are many programs available that would be capable of accomplishing this.

↳ *Appendix maybe?*

Appendices

A Final Budget Spreadsheet

Date Submitted:	4/13/2010					
Group Name:	Inventory					
Advisor Name:	Dr. Gielms					
Income						
Date	Sponsor	Description	Budgeted Amount			
9/1/2005	Engr Dept	Senior Design Project Allocation	\$1,200			
9/1/2005	Venuefair	Additional funds as needed	0			
Total Income			\$1,200			
Expenses						
Date	Vendor	Item Description	PO #	Estimated Cost (\$)	Actual Cost (\$)	Quantity
April, 2010	Ginneys	Final Report		30	N/A	2
April 13, 2010	ULINE	Custom Printed Sticker labels	S-2806	300.00	440.51	4 x 1000
March 19, 2010	Newegg.com	Asus Desktop EEE and Monitor	24-236-069 and 83-220-006	N/A	381.95	1 each
March 29, 2010	Ginneys	Kack Lables	4286	20.00	18.70	1
February 23, 2010	Amazon.com	Microsoft Access 2007	MS_077-02827	200.00	197.97	1
February 16, 2010	Office Max	Labels and Ink	72782068783	50.00	46.25	1
February 6, 2010	Barnes and Noble	Access 2007: The Missing Manual	9780596527600	35.00	37.83	1
Total Expenses				Estimated 635.00	Actual 1123.22	
Budget Remaining				Estimated 555.00	Actual 76.78	

Figure A.1: Budget

B Bill of Materials and List of Vendors

Table B.1: Bill of Materials and List of Vendors

Date	Vendor	Item Description	PO #	Cost (\$)
April, 2010	Ginneys	Final Report		N/A
April 13, 2010	ULINE	Custom Printed Sticker labels	S-2806	440.51
March 19, 2010	Newegg.com	Asus EEE PC and Monitor	24-236-069 and 83-220-006	381.96
March 29, 2010	Ginneys	Laminated Labels	4286	18.70
February 23, 2010	Amazon.com	Microsoft Access 2007	MS 077-02827	197.97
February 16, 2010	Office Max	Labels and Ink	72782068783	46.25
February 6, 2010	Barnes and Noble	Access 2007: The Missing Manual	9780596527600	37.83

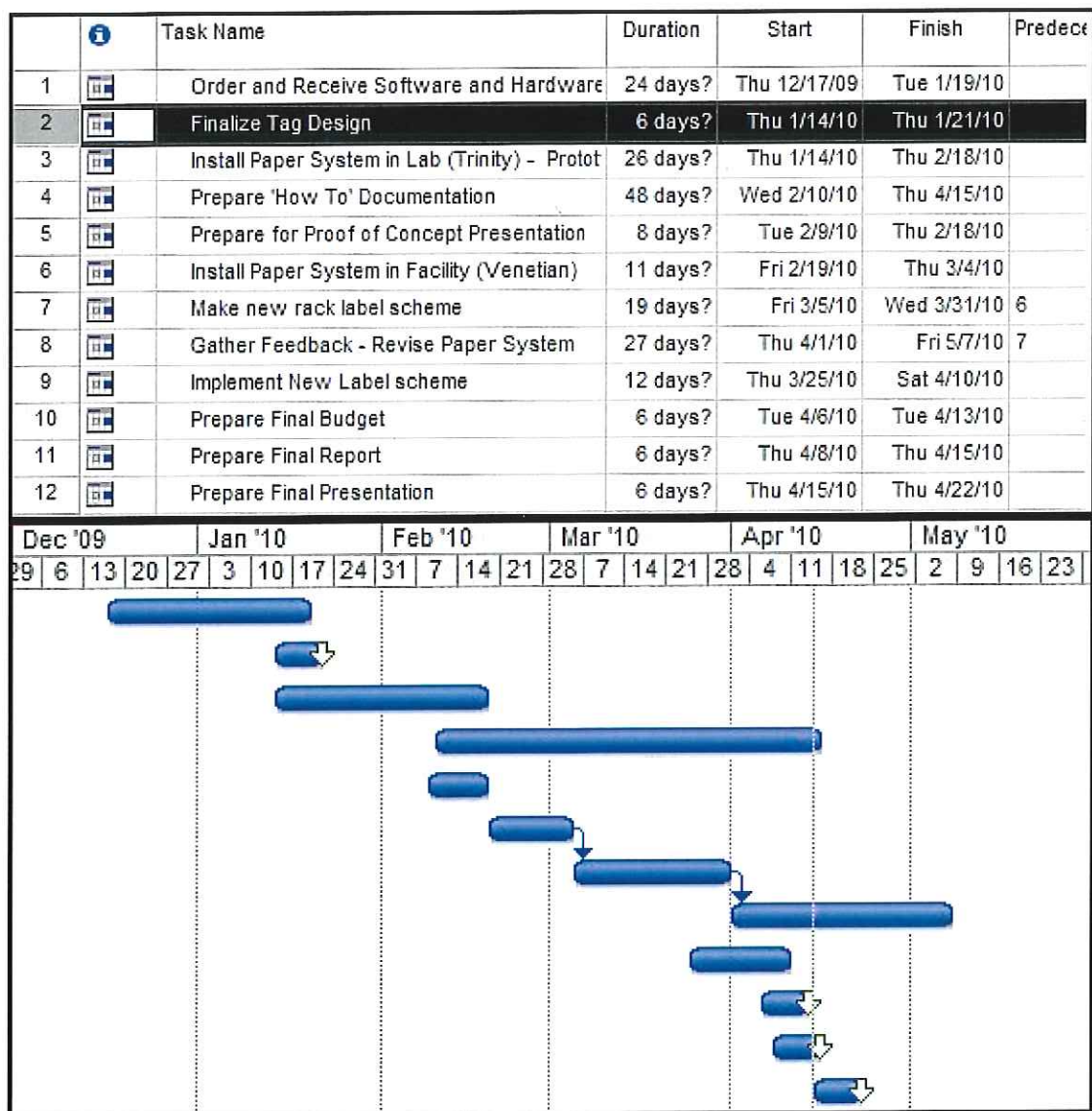
C Final WBS

1. Project Work
 - 1.1. Initiating the Project
 - 1.1.1. Problem Statement
 - 1.1.1.1. Library Research
 - 1.1.1.2. Brainstorming
 - 1.1.1.3. Writing/Editing
 - 1.1.2. Charter
 - 1.1.2.1. Review DocSpec
 - 1.1.2.2. Define Scope
 - 1.1.2.3. Define Requirements
 - 1.1.2.4. Writing/Editing of Charter
 - 1.1.2.5. Meeting with Sponsor at Venetian
 - 1.2. Initial Design
 - 1.2.1. Literature Review / Investigation
 - 1.2.2. Brainstorming Approaches
 - 1.2.3. Analyzing/Testing Potential Approaches
 - 1.2.4. Documentation
 - 1.2.4.1. Design Matrix
 - 1.2.4.2. Design Review Presentation
 - 1.2.4.3. Design Report
 - 1.3. Prototype/Proof of Concept
 - 1.3.1. Specifying Functionality
 - 1.3.1.1. Documenting Instructions for Workers
 - 1.3.2. Ordering Parts
 - 1.3.2.1. Ordering Software
 - 1.3.2.2. Ordering Labels
 - 1.3.3. Construction
 - 1.3.3.1. Creating Access Database
 - 1.3.3.2. Preparing/Applying Labels
 - 1.3.4. Testing/Evaluation
 - 1.3.4.1. Adding Sample Database Items
 - 1.3.4.2. Tracking Items in Lab
 - 1.3.4.3. Testing Labels on Sample from Venetian
 - 1.3.5. Documentation
 - 1.3.5.1. P/POC Demonstration
 - 1.3.5.2. P/POC Presentation
 - 1.4. Final Design
 - 1.4.1. Specifying Functionality
 - 1.4.2. Ordering Parts
 - 1.4.2.1. Order Additional Labels
 - 1.4.2.2. Order Microsoft Access2.4
 - 1.4.3. Construction
 - 1.4.3.1. Update Access Database Features
 - 1.4.3.2. Setup Storage Racks
 - 1.4.3.3. Setup Clipboard Stations at Venetian
 - 1.4.3.4. Re-numbering storage racks
 - 1.4.4. Testing/Evaluation
 - 1.4.4.1. Adding Items to Inventory
 - 1.4.4.2. Tracking Items to Delivery

- 1.4.4.3. Implementing Changes Based on Feedback
 - 1.4.5. Documentation
 - 1.4.5.1. Bill of Materials
 - 1.4.5.2. Instruction Manual
 - 1.4.5.3. Final Report
 - 1.4.5.4. Final Presentation
 - 1.5. Closeout
 - 1.5.1. Cleanup of area/project
 - 1.5.2. Clearance Form
- 2. Administrative
 - 2.1. Planning
 - 2.1.1. Work Breakdown Structure
 - 2.1.2. Schedule
 - 2.1.3. Budget
 - 2.1.4. Project Plan Writing/Editing
 - 2.2. Project Management
 - 2.2.1. Monthly Management Reviews
 - 2.2.2. One-on-Ones w/Dr Giolma
 - 2.2.3. Writing Progress Reports
 - 2.3. Self-Peer Evaluations
 - 2.4. Group Meetings
 - 2.5. Executive Summary
- 3. Course Content (Non-Project)
 - 3.1. Reading
 - 3.2. Studying
 - 3.3. Homework/Quizzes
 - 3.4. In-Class time

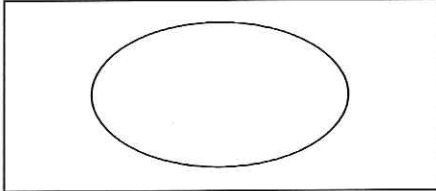
D Schedule

Table D.1: Gantt Chart



E Marble Labels

Work Order: _____ Piece: ____ / ____
 Color: _____ Type: _____ Trim: _____

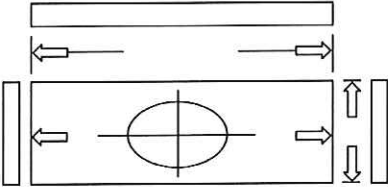


Overflow: _____ Yes ___ No
 Faucet Holes On Deck: _____ Yes ___ No
 Whirlpool: _____ Yes ___ No
 Pneumatic Switch: _____ Yes ___ No
 In-line Heater: _____ Yes ___ No
 Nailers: _____ VM ___ Others
 Skirt Framing: _____ VM ___ Others
 Pump: _____ 3/4hp ___ 1.0hp
 No. of Jets: _____ 6 ___ 8 ___ 10 ___ 12

Figure E.1: Label for Tub

Work Order: _____ Piece: ____ / ____ Color: _____
 Bowl Type: _____ # of Bowls: ____ Faucet Spread: _____

Checklist	
Length	
Width	
Color	
# of Bowls	
Bowl Type	
Faucet Spread	
Splashes	
Location	
Finished By	



Type of Top: _____ Angle ___ Banjo ___ Regular
 Back Splash: _____ Covered ___ Detached
 End Splash: _____ Left ___ Right
 Size: _____ Standard 4" ___ Other
 Edge: _____ Standard ___ Single O.G. ___ Double O.G.

Figure E.2: Label for Counter Top

F - Using the New Inventory System



A User Guide for the Employees of Venetian Tile and Marble
Presented by the inventory group April , 2010

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1. Generating a Work Order

A. Work Order Number Format

A six digit numbering scheme for work orders is used in this database, which will restart one time at the beginning of every calendar year. It is in the format of ‘__ - ____’ where the first two digits are the last digits of the year (so 2010 would be simply ‘10’) and the last four digits correspond to the number of work orders generated in that year (so the first work order generated in any year is ‘0001’). An example would be ‘10-0020’, this work order is the twentieth work order generated in the year 2010.

B. Adding a New Work Order

When viewing the main screen, double left-click on the **Two Pane Inventory** button under the **Forms** section in the left column. Left-click the **Add New Record** button in the pane labeled **Inventory** or left-click on the * in the first blank row. Enter the appropriate information in the pane labeled **Two Pane Inventory**. When adding information to the date fields, there are interactive calendars to make entering information easier. Access these by left-clicking in the desired field and then left-clicking on the calendar icon to the right of the field. When all desired information is entered, left-click the **Refresh All** button in the toolbar at the top of the screen. This button is located under the **Home** tab which is above the taskbar.

C. Adding Multiple Pieces to a Single Work Order

To make adding multiple pieces to a single work order easier, use the **Duplicate Record** button in the **Basic Inventory** pane. To do this, highlight a piece in the same work order you wish to add additional pieces to by left-clicking any field in that row. Then left-click the **Duplicate Record** button. Then update the fields that need to be updated.

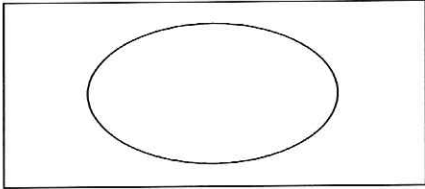
D. Searching for Work Orders

The **Two Pane Inventory** window contains many entries. In order to search for and view inventory that is attached to one specific work order, double left-click the **Work Order Search** button under the **Reports** section in the left column. Then enter the desired work order in the dialogue box that pops up and left-click **OK**. Only one work order search may be performed at once, so ensure that there is not already a **Work Order Search** open. Do this by looking at the tabs directly above the pane that is open, if there is a tab labeled **Work Order Search**, right-click it and select **Close** in the drop down menu.

2. Stickers and Clipboard Stations

A. Using the New Stickers

The sheets of paper that usually follow each piece throughout the manufacturing process will be replaced with a sticker (see examples below) that will be affixed to the bottom of each piece when it is cured, but before it is de-molded. These stickers should be filled out when the inventory is added into the electronic database. The stickers come on a large roll and all should be filled out and kept together. Each sticker will have a blank for the work order number, the piece number in the work order, the color of the piece, the type of the piece, and a schematic of the piece.

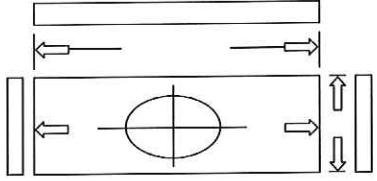
Work Order: _____	Piece: ____ / ____	
Color: _____	Type: _____	Trim: _____
		
Overflow:	__ Yes __ No	
Faucet Holes On Deck:	__ Yes __ No	
Whirlpool:	__ Yes __ No	
Pneumatic Switch:	__ Yes __ No	
In-line Heater:	__ Yes __ No	
Nailers:	__ VM __ Others	
Skirt Framing:	__ VM __ Others	
Pump:	__ 3/4hp __ 1.0hp	
No. of Jets:	__ 6 __ 8 __ 10 __ 12	

i. Sticker type 1: Tub

Work Order: _____ Piece: ____ / ____ Color: _____

Bowl Type: _____ # of Bowls: _____ Faucet Spread: _____

Checklist	
Length	
Width	
Color	
# of Bowls	
Bowl Type	
Faucet Spread	
Splashes	
Location	
Finished By	

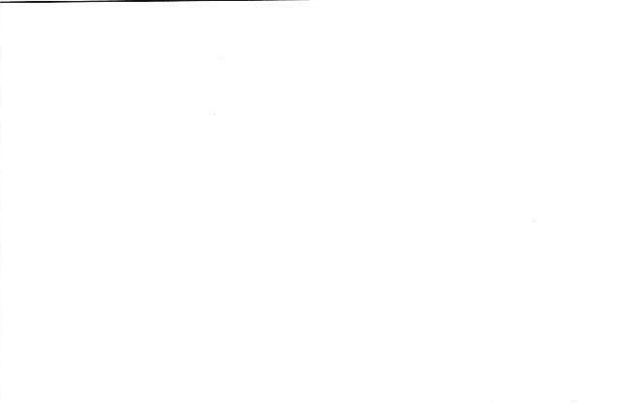


Type of Top: _____
 Back Splash: _____
 End Splash: _____
 Size: _____
 Edge: _____

ii. Sticker type 2: Counter Top

Work Order: _____ Piece: ____ / ____

Color: _____ Type: Integral __ Universal __



Fiberglass: _____
 Drain: _____
 PVC Vinyl Pan: _____
 If Yes: _____

Job Ready Inspection:

iii. Sticker type 3: Shower Base

Work Order: _____ Piece: ____ / ____

Color: _____ Type: Tub__ Shower__ Window__ Other__

3/8" THICK

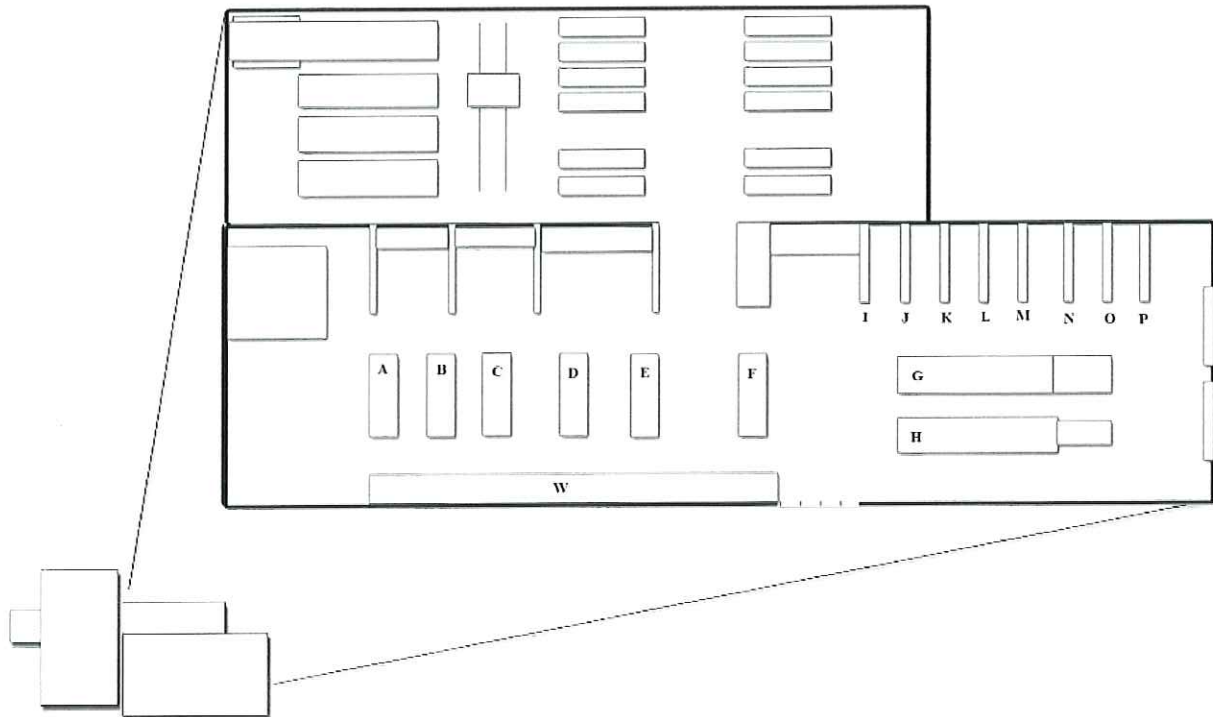
3/4" THICK

Type	TRIM PCS.		ACCESSORIES	
	#PCS	FT Each	Item	Qty
_____	_____	_____	___S/S Combo	___
_____	_____	_____	___Soap Holder	___
_____	_____	_____	___Towel Bar Ends	___

iv. Sticker type 4: Flatworks

B. Storage Rack Numbering System

The storage racks will be provided with a new indexing system. Please observe this for continuity with the electronic database.



C. Clipboard Stations

The clipboards at the areas of production of pouring, finishing, and storage will each be used in a different capacity. Each “station” has a check in/out clipboard that each piece must be checked into and out of through production. An example entry is shown below.

Work Order #	Piece #/ total	Date In	Initials	Date Out	Initials	Mixed/Poured by	Finished by	Location
---------------------	-----------------------	----------------	-----------------	-----------------	-----------------	------------------------	--------------------	-----------------

The example above also shows an entry for location, this column will only be used when the pieces are put in the storage racks before leaving the facility. At the conclusion of business each day, the clipboards will be collected by David for updating the inventory database, it is therefore very important to update these clipboards as specified.

3. Generating Reports

This section covers reports, which show data relevant to a single task. Each report is covered in a subsection below.

A. Delivery Driver Reports

When all pieces are ready for delivery, a report should be delivered to the driver to check against the pieces that are being loaded into the truck. The best way to generate this is to perform a work order search, which produces a **Work Order Summary**. This work order summary is then delivered to the driver, who peels off the stickers from the pieces as they are loaded into the truck and affixed to the bottom of the report. The labels may be overlapped, so long as the work order number and piece number is still visible. Also note that these can only be affixed to the front of the report because they must be scanned to a digital copy for records.

B. Daily Pounds

At the end of a work day, a report of how many pounds were poured in that day can be generate. The first step is to double click on the "Driver Commission" icon under the "Reports" tab. This will prompt an input box for the day. When this is entered, the report will come up with the pieces poured today, how many pounds each piece was, and the total pounds for all the pieces.

C. Driver Commission

When it is time to give drivers their commission, a report can be generated for this. First double click on the "Driver Commission" icon under the "Reports" tab. This will prompt an input box

for the driver's name. Make sure to enter it as it is under the tables. Next, enter the beginning date of the commission period. Then enter the end date of the commission period.

4. Basic Editing of Database

Note: make sure to back up regularly, especially before the database is edited.

A. Adding Fields to Table

To add a field into a form, it must first exist in a table. Double click on "Inventory" under the label: "Tables".

Once this table is open, scroll all the way to the right until the column: "Add New Field" is visible.

If a new field containing text or numbers is needed, double click on the text, "Add New Field". It should be replaced by a cursor. Type the label for this new field.

To display this new field in a form, design view is needed. See section 4 B.

B. Using Design View

When a form is open it will be displayed along the top of the workspace looking like a tab. Right click on this tab to bring up its menu. Click Design View. By using this view, many things can be done (such as adding an existing field, or re-arranging the form).

To add an existing field from a table (as shown in the section above), click "Add Existing Fields" from the "Design" tab in the ribbon. This will bring up a field list on the right side. Adding the field to the report is as easy as left clicking on the item to be added and dragging it over to the form on the left.

To re-arranging the form, click and drag elements to their new location.

C. Queries and Reports

Reports are often based on queries. A query is based on data stored in tables. When a query is executed it searches for entries in a table that match its search criterion. It then pulls specified data into a temporary file. It is from this temporary file that forms are generated. So, if data must be displayed in a report, it must exist in the query it is based on.

D. Additional Help

For a more in-depth look into how to use Access 2007, consult the Access 2007: Missing Manual.

For more information on

- tables and how to change them: see chapters 1 and 2
- forms: see chapters 12 and 13
- queries: see chapter 6, 7, and 8
- reports: see chapter 10 and 11