MEMORANDUM

Date: September 10, 2008

To: The Honorable Chairman and Members
Pima County Board of Supervisors

From: C.H. Huckelberry
County Administrator

Re: **Election Database Electronic Evaluation and Analysis**

Background

A component of election security is the electronic tabulation of votes cast during an election to determine the outcome of a particular election issue. The computer programs and databases necessary to accomplish this task are large and complex. One of numerous election security measures is to analyze the election programs and databases after an election to ensure no programming or database alterations have occurred during the usually lengthy process of vote tabulation. The process of tabulating an election may take five to ten days, with the addition of numerous sequential vote tabulation efforts from multiple day early vote tabulation to election day tabulation to post election, late early ballot question and provisional write-ins ballot tabulation. Software and processes for election database evaluation to detect irregularities in the tabulation sequences and parameters has been developed by Dr. John Moffatt and our Information Technology programming staff.

Democratic Party to Develop a Similar Software

As a result of litigation by the Democratic Party, the Board of Supervisors, on January 11, 2008, released the GEMS databases for the 2006 Primary and General elections as well as the RTA Election to the Party. The Party's stated intention was to develop similar programming to analyze the database sequences to detect any irregularities in the tabulation process. We understand the Democratic Party is working to develop a similar program and will potentially complete same later in this calendar year. In addition, the electronic databases of all elections on the central elections computer were released to the Democratic Party on August 26, 2008. These elections and their individual databases can also be analyzed by the Democratic Party when they have developed their software program for analysis.

Results of County Election Database Analysis

In the meantime, through the software programs developed by the County, the sequential databases of all elections dating from 1998 have been analyzed. The results of this analysis indicate no concern over any election database sequence or series. Minor clerical changes were identified through the analysis, but nothing more. Specifically, the database for the successful Logic and Accuracy Test conducted by the Secretary of State is the baseline for comparison in each election. All subsequent databases for that election are compared back

to the baseline and changes noted and specifically identified. The reports created as a result of this analysis indicated minor clerical changes such as removing candidate's nicknames on one election or changing the title of a bond question to clarify for reporting purposes. Nothing was identified related to changing any of the tabulation parameters that would affect the outcome of any of the elections. More detailed information regarding this analysis is included in Attachment 1, which contains the analysis and documentation of every election database since 1998. This information is provided on a compact disk for ease of further analysis by others.

Program Documentation

The design specifications for the specific programming associated with development of this analytical database analysis tool and step by step documentation of the Pima County programs is provided as Attachment 2 to this memorandum. Pima County would be happy to share this analytical tool with any other governmental or non-profit entity who may wish to provide further election security related to electronic vote tabulation.

RTA Election Database Analysis

Particular attention has been paid to the RTA database, and its analysis of the RTA electronic information files and databases have been the subject of at least two forensic computer actions. The analysis conducted by the County using its newly developed programming provides the third. The results of the Department of Public Safety forensic computer analysis, as well as the analysis by *iBeta*, have indicated that while there are security flaws in the GEMS software and security in the GEMS database approach, no evidence of tampering was found. Our analysis using the newly developed software program for a more detailed database analysis indicates the same -- no evidence of vote fraud or manipulation. The Elections Database Archives Comparison is included as Attachment 3.

Release of September 2, 2008 Primary Election Database

As directed by the Board, the County will release the electronic database of the September 2, 2008 Primary Election following specific security procedures to ensure that the database cannot be modified or manipulated without detection. This release will occur after the canvass of the election by the Board on September 12, 2008. The databases, along with the printed reports from the database analysis program referenced above and other files requested by the Parties during the Primary Election, will be copied and turned over in accordance with the File Validation and Transfer Procedure.

We are pleased to have been able to develop this additional electronic tool to improve transparency and to ensure the integrity of Pima County elections.

CHH/jj

Attachments

c: Dr. John Moffatt, Office of Strategic Technology Planning
Brad Nelson, Elections Director

Attachment 1

Historic Database Comparison Results
(on CD provided with hard copy)

Attachment 2

Pima County Programs Database Analysis Tool

Elections Database Archive Comparison

1 Document Control

Project Title	Elections Database Archive Comparison
Department	Elections
Sponsor	Dr. John Moffatt, Strategic Technology Planning, 740-8463 Brad Nelson, Elections Department, 351-6830
ITD Manager	Chuck Decker, 243-7110
Project Manager	Edward Wittke, 243-7115
Business Analyst	Edward Wittke

2 Acceptance

I have read the Statement of Work and will abide by its terms and conditions and pledge my full commitment and support for the project.

	Name	Department	Role	Signature	Date
1	John Moffatt	County Administrator	Sponsor		
2	Brad Nelson	Elections Department	Sponsor		
3	Chuck Decker	IT Department	Development Manager		
4	Edward Wittke	IT Department	Project Manager		

3 Document Version

Date	Description
03/31/2008	Preliminary draft
05/14/2008	Initiation Statement of Work FINAL
06/18/2008	Planning Statement of Work DRAFT
08/01/2008	P-SOW DRAFT, added Testing procedures, comparison section
08/19/2008	P-SOW DRAFT, added Installation procedures. Various minor updates
09/09/2008	P-SOW FINAL, few minor updates. Source Code

Location of file in Source Control:
/Elections Department/Elections Database Archive Comparison Project/
Filename: SOW-ElectionsDatabaseArchiveComparison.doc

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5 Introduction

5.1 Background

Pima County uses a voting solution system for managing and recording ballots from elections.

The current vendor is Premier Elections Solutions (formerly Diebold) providing the following:

- GEMS (Global Election Management System) manages every step of the election process, from ballot layout to election reporting. The election management and tabulation software automates the complete election cycle.
- AccuVote-TSX is a self-contained onsite voting reader unit that automatically records and stores encrypted ballot information and election results.
- AccuVote-OS is a precinct and central accumulation optical scan voting system

GEMS uses a Microsoft Jet database file (*.MDB) containing the necessary election tables that include all key data elements of the election process including precinct/district setup, to race definition, tabulation and reporting.

Tabulating votes in elections, in itself, is a high visibility activity where all parties are interested in safe-guarding the entire election process from beginning to the end. Procedures are in place to protect the data and validity of the election. Party observers are present during all interactions with the voting solution system.

5.2 Problem Statement

There is a request to verify that key data elements within the GEMS management database have not been tampered with (by "flipping" values) after the database has been SET and the Logic and Accuracy (L&A) testing had been completed by the Secretary of State. The Secretary of State gets a copy of this SET database.

Key Data Elements is defined as program/control parameters and configurations (ballet definitions, precincts, report definitions, etc)

SET is defined as all configurations and settings for key data elements that have been completed and defined as "locked", also known as the LNA.

5.3 Solution

Backups of the GEMS database file are performed throughout the tallying process at key intervals and each backup is retained. Specific key data elements within the GEMS database have been defined as vital/essential and do not change during the course of the election.

A software solution will be developed to access each archived backup of the GEMS database and perform a comparison between all backup versions and create a report on all the key data elements that match and those that do not match.

The application, commented source code and documentation will be created and provided to the sponsor.

6 Scope

The scope of this project is to develop a system that will analyze and report on all GEMS database archive backups. This application will certify that no changes have occurred on key data elements.

To be able to have a systematic and controlled distribution process, a Licensing system will be used to allow users wanting to use the application to register with Pima County and receive a unique License Key.

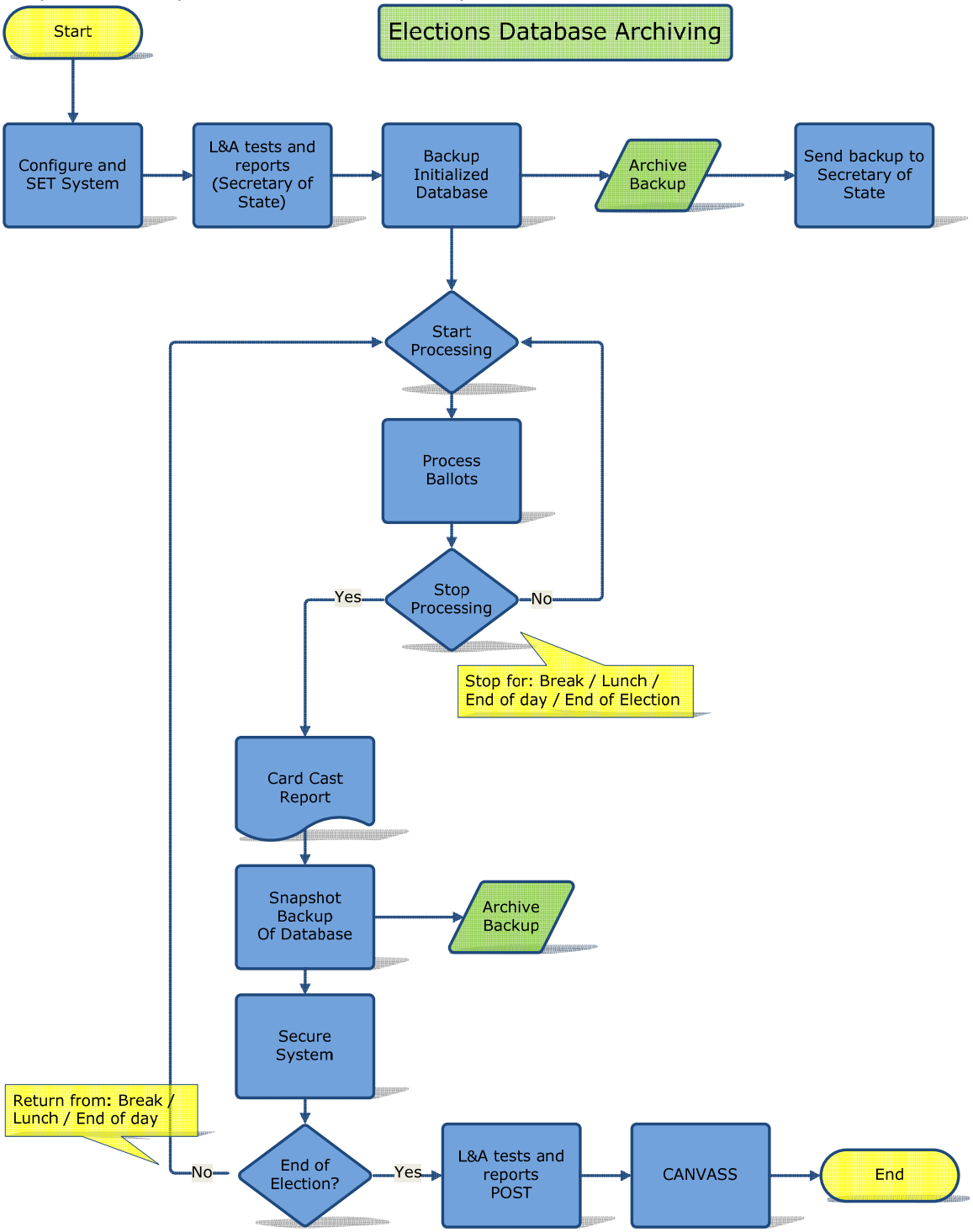
There are other processes that have already been implemented to ensure the integrity of the election process but are out of scope and not discussed or defined in this document.

7 Responsibilities

Who?	What?
Sponsor	• Provide information necessary to specify requirements in this Statement-of-Work (SOW) • Review Statement-Of-Work ensuring that needs are being addressed • Ensure solution complies with city, state and federal guidelines • Ensure that all users receive the approved training/information • Provide sample databases for testing • Provide necessary information pertaining to database architect and data elements • Distribute any related materials
ITD	• Create and maintain the Statement-of-Work (SOW) • Create and maintain the project plan for this project • Co-facilitate requirements • Write detailed requirements • Either develop or help in the process of the software solution • Control the Change Management process • Provide initial user training/documentation • Meet the system design requirements as defined in this project

8 Process Flow Database Archiving

The process we are concerned with is the sequence of events pertaining to the archive backups of the GEMS database. Other processes are not defined. The "Archive Backup" processes shown in the diagram represent the points in time that backups can occur.



9 Functional Requirements

Note: The full description of the Election process is out of scope of this project. The following requirements are defined for this project.

9.1 System Inputs

Number	Description
si01	Capability to load multiple MDB (Access) databases
si02	Configuration file listing all Key Data Elements
si03	Configuration file will have user changeable preference settings
si04	Licensing to use software is required and will be tied to one specific computer

9.2 System Processes

Number	Description
sp01	User will start the program and the main screen will load with instructions
sp02	User will click on the BROWSE button to browse to folder that contains the MDB files.
sp03	Able to select which database is the SET database that all other databases will be compared against
sp04	User changeable filename text to determine which file is the SET database and Post-SET databases. Reference naming standard document: *Pima County Elections - Premier GEMS Database File Naming Convention*.
sp05	All selected databases will be listed on the main screen
sp06	All Key Data Elements will be listed on the main screen and selectable to compare
sp07	User will click on the SHOW REPORT button to open a report that displays the comparison results
sp08	Licensing will require a process of requesting a License Key using unique computer identifiable information and a name
sp09	Licensing will require a response to be performed by a Pima County representative, to the request of a License Key

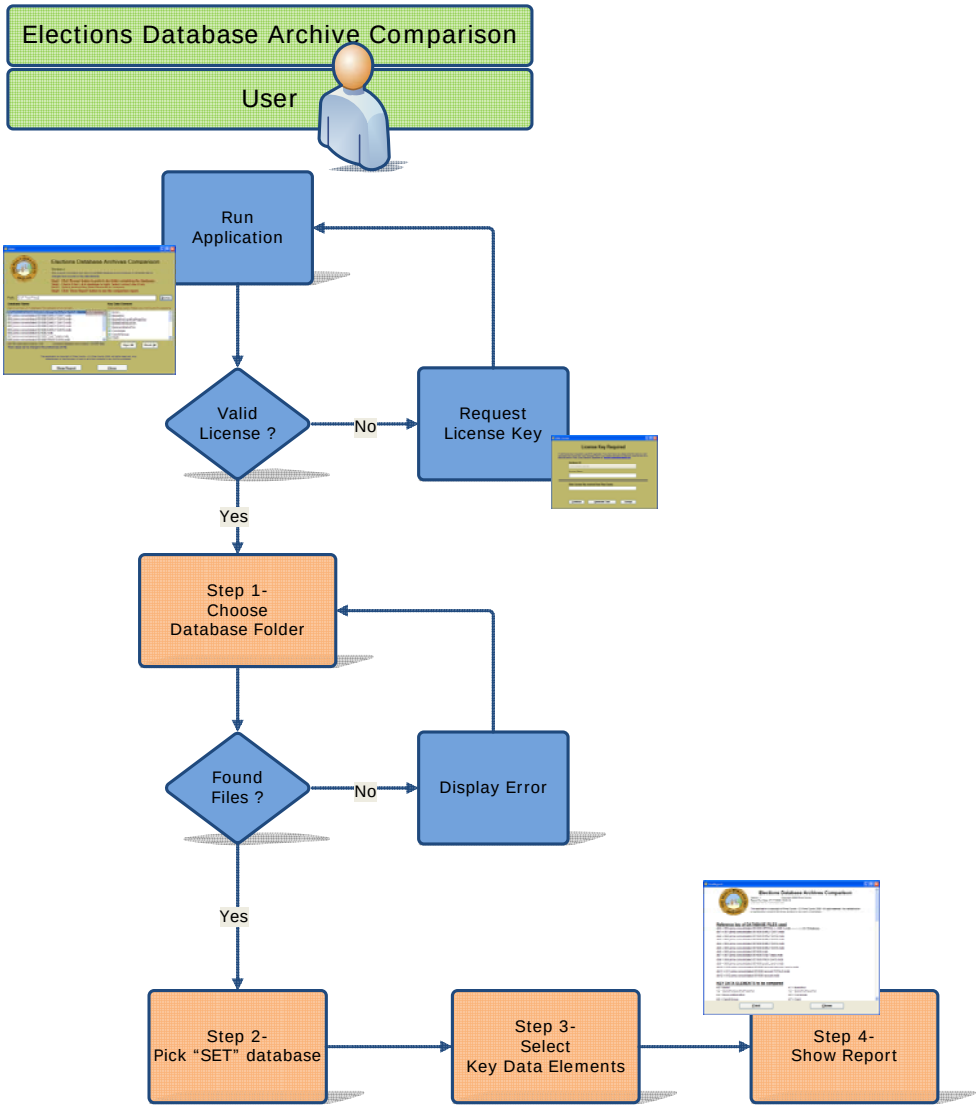
9.3 System Outputs

Number	Description
so01	Report of results with details that can be printed
so02	Output of a License Key to the requester

10 Functional Design Flow

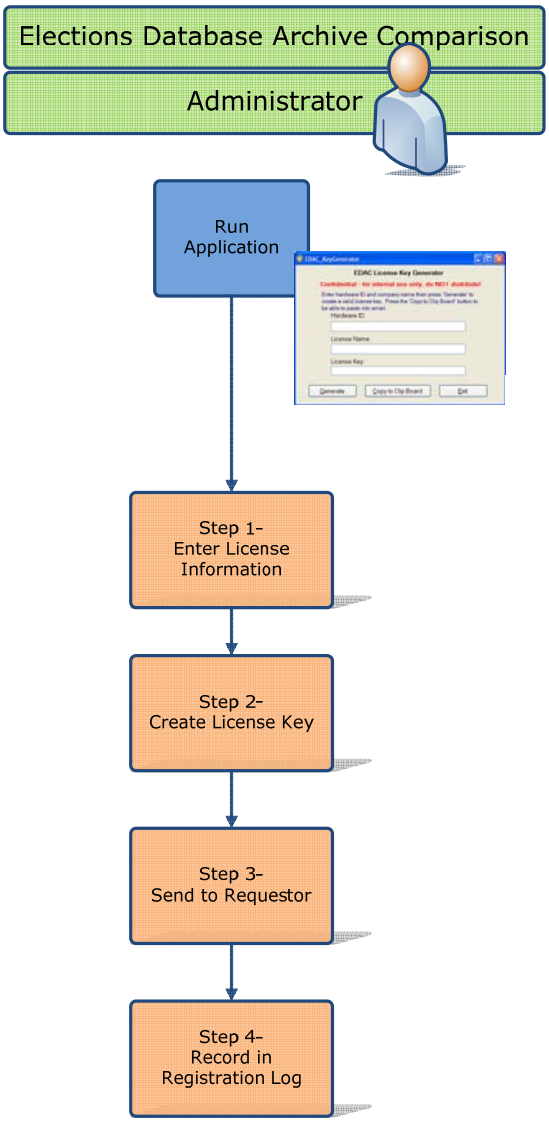
10.1 Process Flow for the USER

1. User will start the program and the main screen will load with instructions
2. The program will read from the preferences.xml file and (a) Load all Key Data Elements, (b) Read Preferences for filename conventions and (c) Read Licensing Information
3. If the License Key is not valid, the License Page will load with instructions
4. Step 1 - User will click on the BROWSE button to point to folder that contains the MDB files
5. All selected databases will be listed on the main screen
6. Step 2 - Pick the SET database that all other databases will be compared against
7. Step 3 - User can choose specific Key Data Elements to compare. Be default, all Key Data Elements will be chosen
8. Step 4 - User will click on the SHOW REPORT button to show the results that can be printed and/or saved.



10.2 Process Flow for the ADMINISTRATOR

1. Administrator will receive the HardwareID and License Name from the USER
2. Step 1 – Enter License Information exactly as received. Information is case sensitive.
3. Step 2 – Create the License Key
    a. Click on the Generate Key button to create a unique key that uses both the Hardware ID and License Name
4. Step 3 – Send to the Requestor
    a. Click on the Copy to Clip Board button to place all three fields in the clipboard
    b. Start an Email and paste the information into the email
5. Step 4 – Record user information in the registration log



11 Benefits

- Provide a means to ensure validity and consistency of data elements within GEMS database
- Licensing provides a control distribution of the application

12 Risks

- Vendor has stated which data elements should be compared but has not specified exactly which of the listed data elements are locked verses those that change throughout the election process.
- The confidential License Key generator is inappropriately distributed to the public and eliminates the controlled distribution process

13 Assumptions

- Provided information on required key data elements are accurate
- Only doing comparisons of a small set of parameters and configuration settings. This solution will not analyze logs or access thousands of records
- Distribution of the software with the authorization of a License Key could present a personnel burden

14 Training

Training will be the responsibility of the Elections department. IT Department will not train new users to the system. Any training of users after the final acceptance of the system will be the responsibility of the sponsor.

15 Technical Support

IT will provide technical support on the developed applications. Post implementation support will occur through standard IT Department help desk procedures.

16 Environment

16.1 Minimum System Requirements

- Microsoft Windows operating system
- Microsoft .NET Framework 2.0 installed (Microsoft Access is NOT required)
    - Microsoft .NET Framework Version 2.0 Redistributable Package
    - Free install through http://www.microsoft.com/beta/downloads/
- You must have Administrator permissions on the computer in order to run the installer.

16.2 Not-Supported

- Virtual environment, where a HardwareID is not available, is not supported

17 Installation Procedures

See "16.1 Minimum System Requirements" for proper application environment

17.1 Verification of files

A SHA-1 (Secure Hash Algorithm) hash value will be created to check the integrity of the executable file against unauthorized alterations or corruption. It is up to the user to validate this value against the executable. There are freely distributed applications available to verify the SHA-1 hash value against the application.

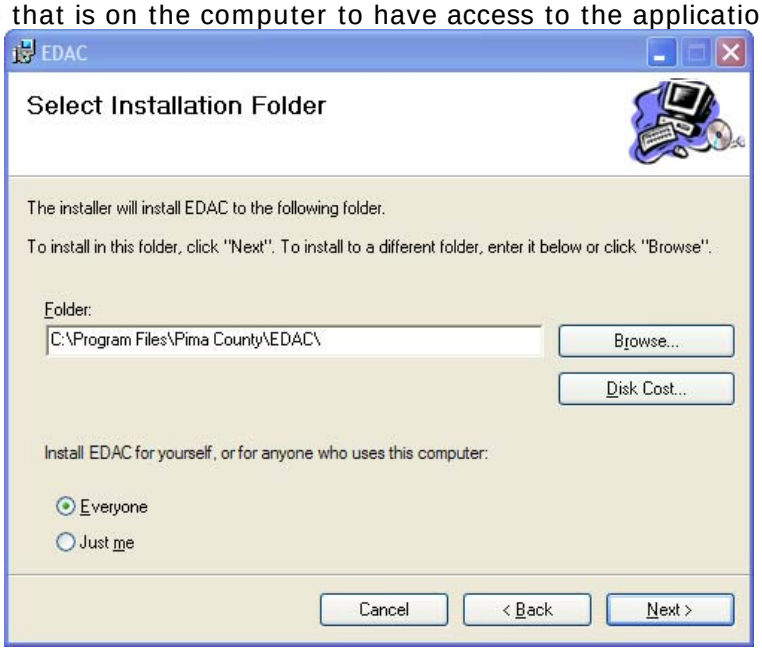
17.2 Installation Steps

In Windows, locate the "EDAC Installer.msi" file and double-click to run the installation package wizard.

17.2.1 Welcome Screen

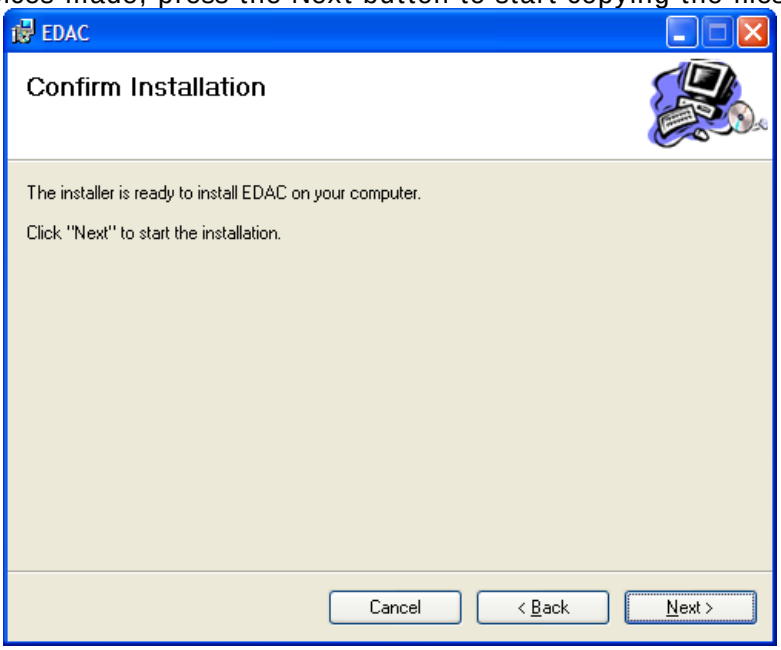
17.2.2 Select Installation Folder

The default location for the EDAC files is listed and can be changed if desired. The User also has the ability to allow everyone that is on the computer to have access to the application.

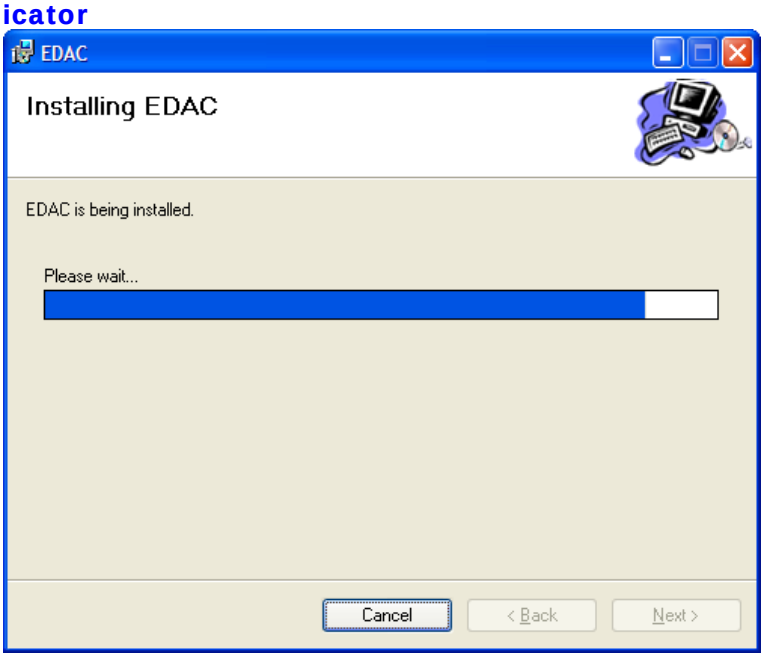


17.2.3 Confirmation

To process with the choices made, press the Next button to start copying the files to computer.

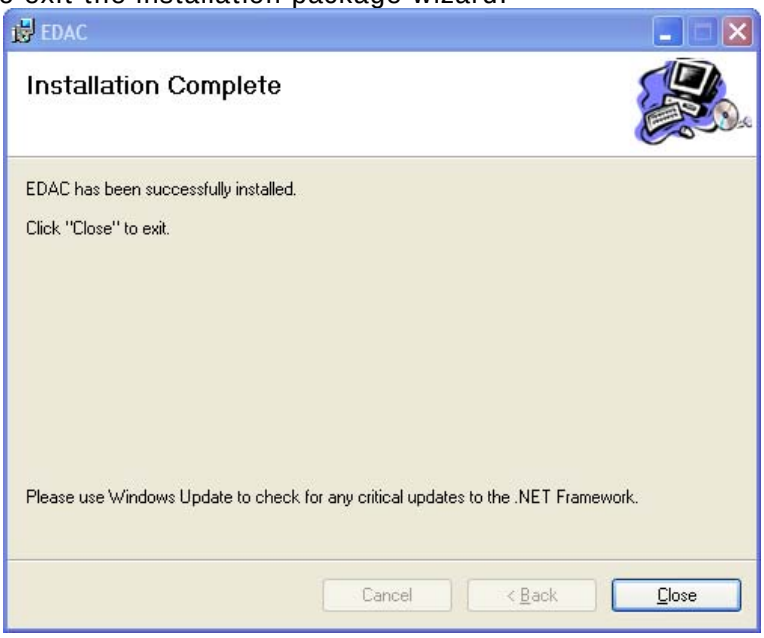


17.2.4 Progress Indicator



17.2.5 Installation Complete

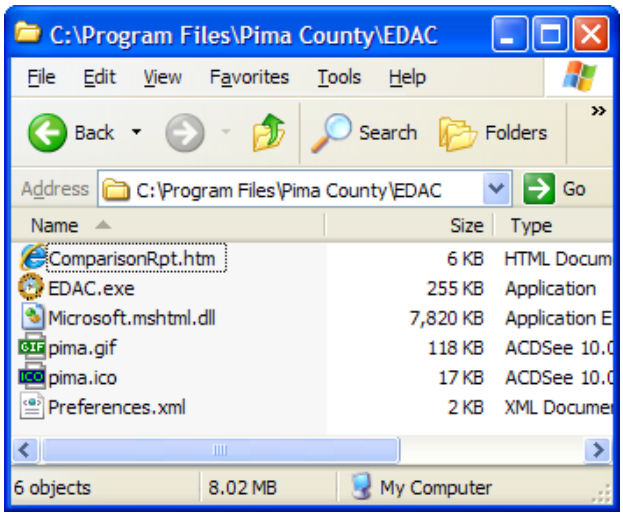
Press the Close button to exit the installation package wizard.



17.2.6 Resulting files

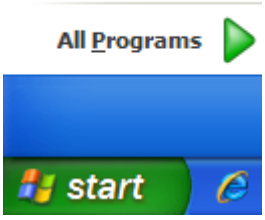
The installation package wizard created the appropriate folder and installed the necessary files into this folder.

See "18.8 USER Support Files" for file descriptions. The "Microsoft.mshtml.dll" file is a standard control from the .NET 2.0 library and is necessary for the reports screen to render. Note: the files sizes below are for example only and may differ from the final version.



17.3 To Run the Application

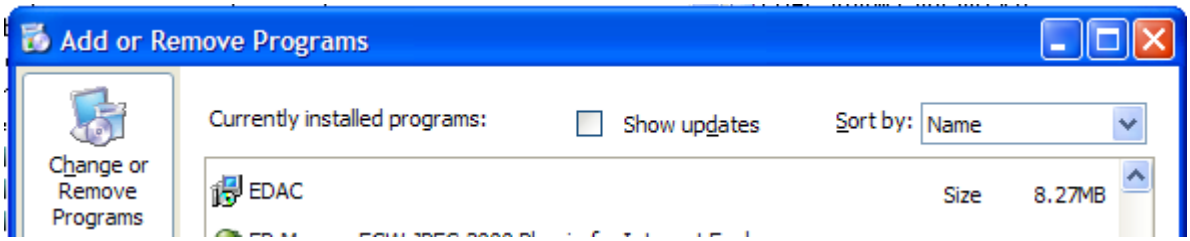
To start the application, go to the Start menu, All Programs and find EDAC menu item in the root of the All Programs menu.



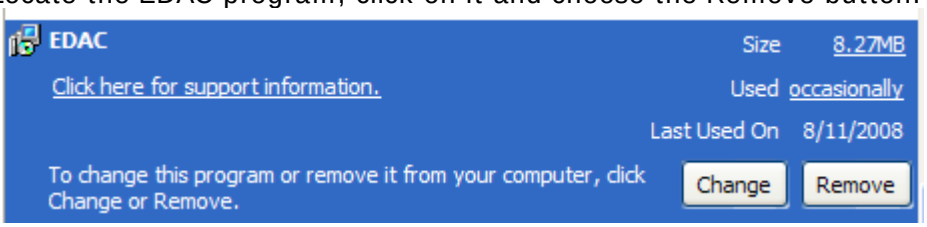
There is also a shortcut on the desktop.

17.4 Uninstalling the Application

To remove EDAC and the supporting files from the computer, make sure the application is not running and go to the "Add or Remove Programs" from the Windows control panel.



Locate the EDAC program, click on it and choose the Remove button.



18 Detailed Technical Requirements

The detailed technical requirements section of the Statement of Work (SOW) is designed to give specific instructions to the developer(s) on what is required in the software solution. Changes to the detail technical requirements will occur during the development phase due to technological advances, new discoveries or change in scope.

18.1 Overview of Logic

18.1.1 Application

A Windows Application (not an ASP.NET Web Application) is created to allow for easy distribution. A SHA-1 hash value will be created to check the integrity of the executable file against unauthorized alterations or corruption. It is up to the user to validate this value against the executable.

The application will be broken down into two separate pieces. The first part (EDAC.EXE and support files) is to be run by the USER and will do the actual work of loading the databases and doing the comparison. The second part (EDAC_KeyGenerator.exe) is only used by a Pima County representative (ADMINISTRATOR) to generate the License Key based upon the information provided by the USER while running the first part. The second part will not be distributed.

18.1.2 Preferences

A list of key data elements that are used for configuration and setting the parameters for an election will not be hardcoded in the application but stored in an external preferences file. This will allow users the capability to add or remove data elements if the GEMS database changes in future (or past) versions.

The preferences.xml file holds all Key Data Elements and preferences.

18.1.3 Database files

The application will load all MDB files that are within the folder that the user chooses that end with the MDB extension and also match the filename criteria stored in the preferences file (See "18.8.1 Preferences.XML").

The folder may contain archived backups prior to the SET database that will not be used in the comparison process. As per the "18.3 Database Standard Naming Convention" section, Element #5 will have specific words describing the time frame of the backup. Only the SET and backups after the SET database will be loaded and compared.

No information is ever written to the databases.

18.1.4 Key Data Elements

The tables and field names will be read from the preference file and each database file will be confirmed to hold the desired data elements (See "18.5 Actual Key Data Elements").

When a TABLE name is identified as a Key Data Element, then all rows and columns are compared from the SET database to all other databases.

When a TABLE, FIELDNAME AND VALUE are identified as a Key Data Element, then that single value of the SET database is compared against all other databases.

The user has the ability to manually add and remove values through the preference file (See "18.8.1 Preferences.XML").

18.1.5 Comparison

The Key Data Elements of the SET (L&A) database will be compared to every other database file and will be identified if the databases Match or are Different. If the fields or values do not exist, an error is identified.

The application will compare entire tables that include multiple rows and multiple columns (e.g. Race) to verify that no value has changed.

The application will also compare specific records identified as Key Data Elements to allow validating specific rows within a table. This will be labeled as Table, fieldname holding the primary key reference and the primary key's value (e.g. Preference/KeyID/25).

If there are any differences ("Not Matched"), then the difference needs to be identified and the values from the SET database and the Not Matched database are to be displayed.

18.1.6 Report

The output will take the comparison results and display all necessary items in an easily readable form. Minimum sections will include: database names, data element names, status if all the values match or not match and if not matched, list the values.

Basic information will be listed to reflect and date and time the results were run and include additional information to help validate the results. See "18.7 below USER Report Specifications" for more detail.

18.1.7 Licensing

To be able to have a systematic and controlled distribution process, a Licensing system will be used to allow users wanting to use the application to register with Pima County and receive a unique License Key.

The application will reference the motherboard's serial number as the hardware identifier to uniquely identify the computer. The combination of the hardware identifier and the case-sensitive named entered by the USER will used to create the License Key.

18.2 Definition of Terms

- Key Data Elements are program/control parameters and configurations (ballet definitions, precincts, report definitions, etc)
- SET is when all configurations and settings for key data elements that have been completed and defined as "locked".
- LNA/L&A - Certified Logic and Accuracy database. See "Set".
- USER are customers who will use the program
- ADMINISTRATOR is the person who will generate a License Key for the User and log the information into a log. This person will be a representative of the program owner.
- EDAC is the abbreviation for "Elections Database Archive Comparison" executable file.

18.3 Database Standard Naming Convention

The requirement is that all databases will end in an MDB extension and reside in a single folder and follow the following guidelines located in the document "*Pima County Elections - Premier GEMS Database File Naming Convention*". See document for full details.

In summary, the document identifies six specific elements that will be used when creating an archived backup of the database. No spaces will be used between each element. The six elements are as follows (sample included):

- Element #1: Official Election Date (YYMMDD)
- Element #2: County of Election (PIMA)
- Element #3: Type of Election (PRIMARY)
- Element #4: Backup Date Time stamp (YYMMDDHHMM)
- Element #5: L&A Status ("PRE" or "LNA" or "POST")
- Element #6: Definition of sequence (User free-style description)

For example: For the September 2, 2008 Primary Elections in Pima County a backup was performed on August 6th at 7:30am when the first early ballots are to be processed.

Example: 080902PimaPrimary0808060730POST early day01 All

The requirement is to easily identify only the SET/LNA database and only those databases that occur after the SET database, i.e. POST.

18.4 Local Database Tables and Relationships

Not Applicable. There are no tables used for the operation of the application. All preferences are stored in an XML file.

This software solution opens the vendor's databases but does not perform any writes to the databases.

18.5 Actual Key Data Elements

The following email message has been received from the vendor noting specific tables to examine.

The appropriate Key Data Elements will be placed in the preferences.xml file to note which tables and fields to use for comparisons. Each Key Data Element needs to be identified as either comparing a whole table (every row and every column) or a specific table's fieldname with a specific Primary Key value.

The follow are abstracts from the emails received:

Per the vendor's email dated June 05, 2007 (2:30pm), Tab Iredale referenced the following tables:

- Counter tables
  - CounterBatch
  - RaceCounter
  - CandidateCounter
  - CardRotCounter

- Race, candidate and vgroup (party) tables
  - Race
  - CandVGroup
  - Candidate
  - VGroup

- Precinct and Districts
  - District

- Summary tables (updated when reports are run if results have changed)
  - SumRaceCounter
  - SumCandidateCounter
  - SumCardRotCounter

- Table that controls the ballot layout:
  - BaseunitBallotRot
  - BallotRot
  - Ballot
  - CardRot
  - Card
  - PlateRot
  - Plate
  - PlateRace
  - PlateHeader
  - BallotRotCardRotPlateRot
  - BallotRotRaceRot
  - Preference entries (keyId value) 20, 21, 25, 55, 110, 120, 140, 150, 160, 190

Per the vendor's email dated June 11, 2007 (10:26am), Tab Iredale referenced the following tables:

The AccuVote-OS and AccuVote-TSx parameter are stored in the GEMS database. They are stored in the Preference table under the following keys:

```
CARDLAY                 = 20,    // card layout config entry
CARDAUTOLAY             = 21,    // card auto layout config entry
CARDMARGINS             = 25,    // margins config entry
AV_PARAMS               = 50,    // AccuVote parameters config entry
TS_BALLOTDEF            = 55,    // TouchScreen ballot definition config entry
ABASICREPORTNAME        = 60,    // ABasic report name config entry
CARD_PRECINCTID_TYPE    = 140,   // card precinct ID config entry
AVTS_PARAMS             = 190,   // AccuVote TouchScreen parameters
```

As for the card position (programming parameters) information this is stored in the PlateRace.VPosTable entry which is an ASCII encoded string that contains the number of entries followed by the row and column coordinates of each candvgroup (candidate and vgroup combination) in the base rotation order.

The hash value stored in the Ballot, BallotRot, Card, CardRot, Plate, and PlateRot is the hash of the Race Id's and Race Rotations (for the …Rot tables) of the races that make up the item. This is used during ballot layout to enable quick checking for matching Ballots, Cards, or Plates.

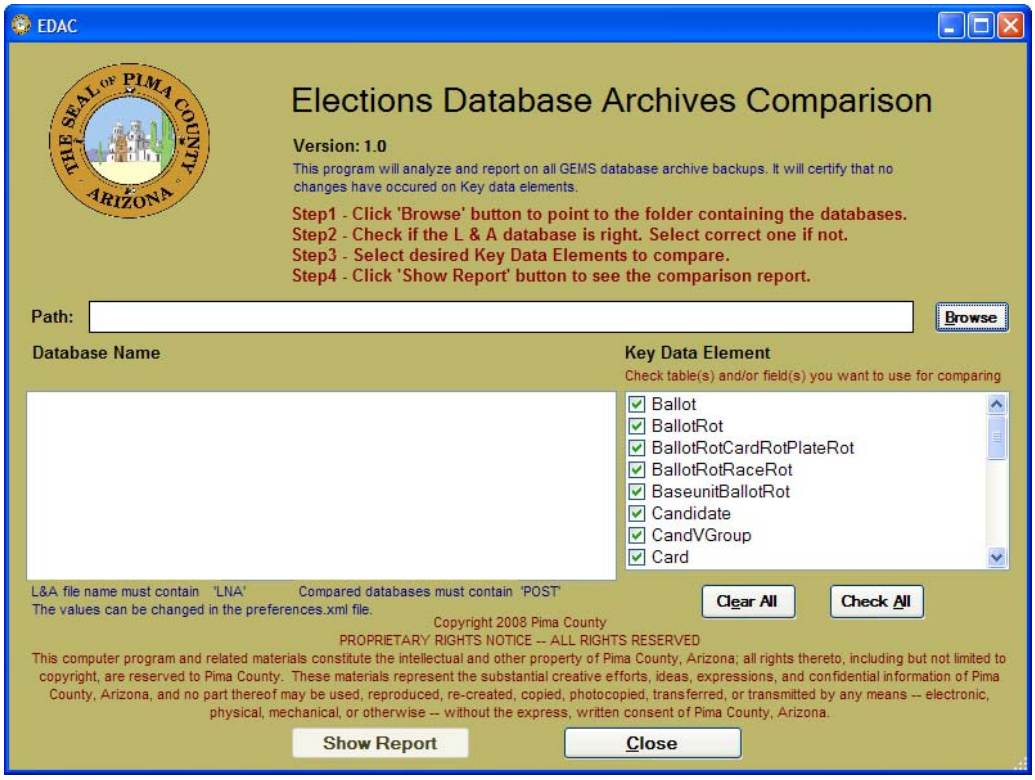
18.6 USER Screens Specifications

The USER is considered customers who will use the EDAC.EXE program for database comparisons.

1. User will start the program and the main screen will load
2. The program will read from the preferences.xml file and
   (a) Load all Key Data Elements,
   (b) Read Preferences for filename conventions and
   (c) Read Licensing Key Information
3. If the License Key is not valid, the License Page will load, otherwise the Main Screen will be displayed.

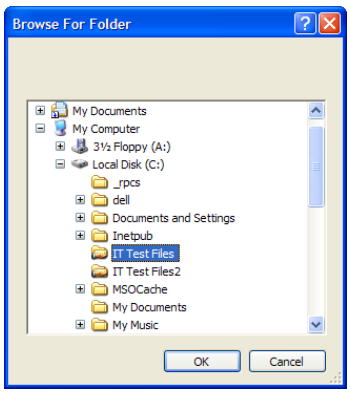
18.6.1 Main Screen Specifications

See section "10.1 Process Flow for the USER" for flow diagram of steps that the USER will perform.



Step 1 - Click on the BROWSE button to point to folder that contains the MDB files.

Browse
After clicking on the BROWSE button, the user will navigate to the folder that contains the backup database files.



Error: No files found
If the User selects a folder that does not contain any MDB files, then the following message box will appear.

All databases will be listed on the main screen that meet the file naming convention as defined in the preferences file (See "18.8.1 Preferences.XML"). On screen, below the "Database Name" window, shows the text that is being compared against the filename. The text MUST appear as the Element #5 (See "18.3 Database Standard Naming Convention").

For this example, the SET database is looking for the letters "LNA". The POST databases, as shown here, will look at all database files in the folder.

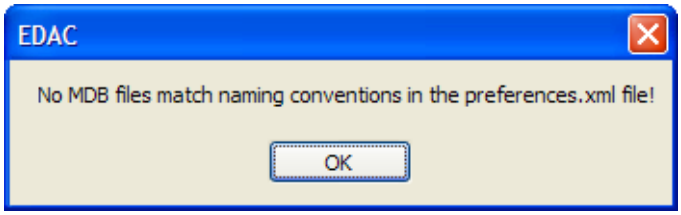
Following the naming convention, the typical letters to look at are "POST".

L&A file name must contain 'LNA' Compared databases must contain 'POST'
The values can be changed in the preferences.xml file.

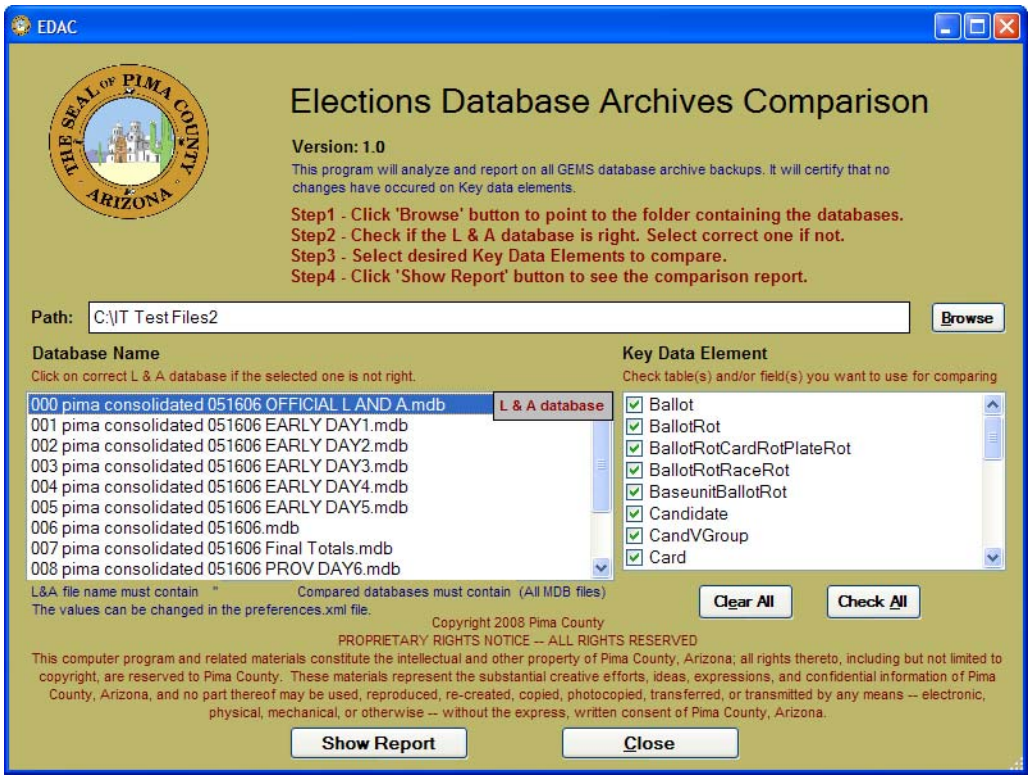
IF "POST" is not to be used then the value can be cleared and all databases will be loaded.

L&A file name must contain 'LNA' Compared databases must contain (All MDB files)
The values can be changed in the preferences.xml file.

Error: No files match
If none of the databases in the folder match the naming convention for "LNA" and "POST" databases.

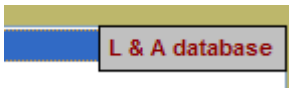


Step 2 – Pick the SET database that all other databases will be compared against
After the databases are successfully loaded (see image below), the SET/LNA database needs to be the first database in the list.



The EDAC application will attempt to automatically choose the SET/LNA database based upon the preferences file's textual match. If no database is found, then the list is listed alphabetically.

The USER has the ability to pick any file from the list by single-clicking on the filename and it will appear at the top of the list next to the label (see image at right).

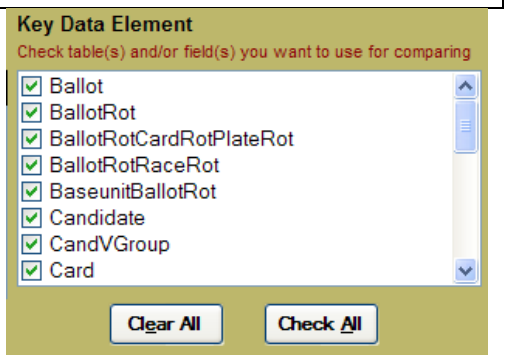


The remaining files will be listed in alphabetic order. It is important, but not required, to follow the standard naming conventions (See "18.3 Database Standard Naming Convention") to keep the files in chronological order.

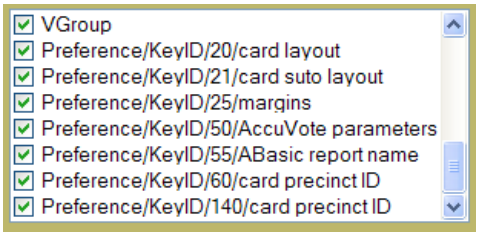
Step 3 - User can choose specific Key Data Elements to compare.
The list of valid Key Data Elements are listed in the preferences file and loaded at start up. This list provides a quick reference to know what items will be compared.

By default all Key Data Elements will be selected for comparison. If for any reason the USER wants to only look at specific Key Data Elements, that capability is available.

Example list of TABLES within the GEMS database. Every row (RECORD) and column (FIELD) will be compared within the table.



Example list of FIELDS within the GEMS database. The list contains the specific TABLE, FIELDNAME and PRIMARY KEY VALUE to compare. An DESCRIPTION is included for readability and understanding and not used as part of the comparison.



The list can be altered by modifying the preferences file (See "18.8.1 Preferences.XML"). The application needs to be restarted for the changes to take effect.

Step 4 - SHOW REPORT button to show the results that can be printed and/or saved.
The SHOW REPORT button becomes active successfully browsing and selection the folder where the backup databases are located.

Click on the SHOW REPORT button to start the comparison.

During the comparison process, a progress bar appears showing the status. The current database name is listed and a percentage indicator is displayed.

18.6.2 License Screen Specification

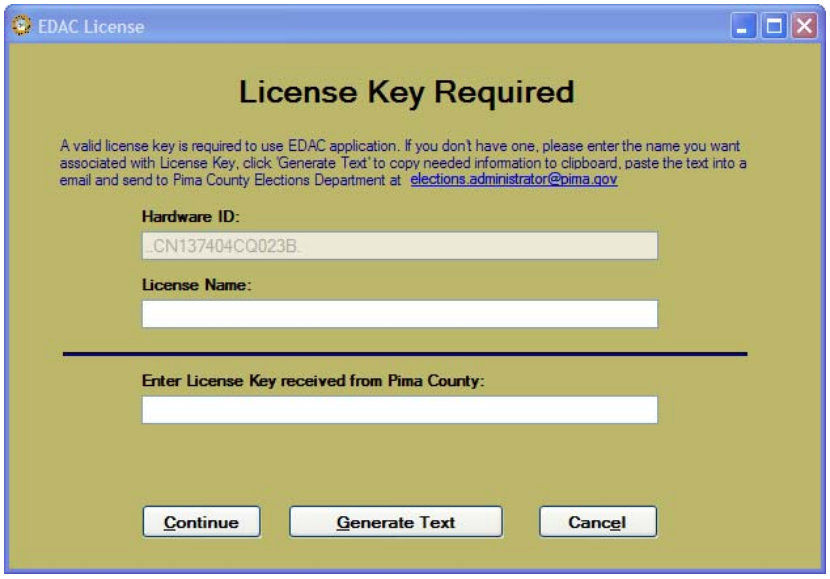
At run time, if the License Key is not valid, the License Page will load asking the USER to license the application. The application will not run without a valid license key.

The application will load and confirm that (1) the hardwareIDs match between the preferences file and the computer, then (2) Validates the hardwareID and the License Name against the License Key. If the validation passes, then the program continues to the main screen. If the validation fails or not yet initialized, then the License form is loaded with instructions and prefilled with the hardware ID (See "18.1.7 Licensing").

18.6.2.1 Steps if USER does not have a License Key

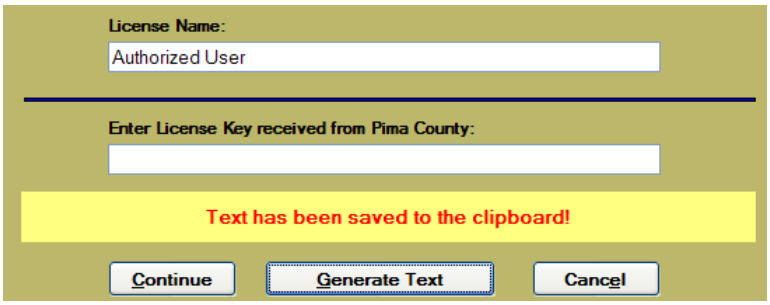
The first time you run the application on a new computer, you must provide the ADMINISTRATOR the unique Hardware ID and the License Name.

The Hardware ID is automatically calculated and the USER is not able to change it. It is listed for informational purposes only.



Step 1

The USER must enter a License name that they want associated with the application. The name will be displayed on the report.



Step 2

After entering the License Name, the USER will click on the Generate Text button to copy to the Windows Clipboard the instructions, hardware ID and License Name along with additional information.

The License Name will be displayed on the report.

Example of text that is copied to the clipboard:

```
Instruction:
Thank you for using the Elections Database Archives Comparison (EDAC) application.  You must first license this software.
Send an email to elections.administrator@pima.gov with the following information and a license key will be returned.  Please
allow up to two business days, excluding holidays, for processing.

Software:  EDAC
Version: 1
HID: ..CN137404CQ9999.
License Name: The Preferred Username
Email to send to: elections.administrator@pima.gov

To register, please fill out the following information:
Company Name:
Phone Number:
Email address:
```

Step 3

The USER will then exit the application and send an email to the email address provided in the text.

The USER will start their normal email client software (Outlook, msn, gmail, yahoo, etc) and start a new email message. In the body of the email message the USER will paste the text that was captured (Ctrl-V or through menu options).

From the text, the USER can copy and paste the email address into the TO field.

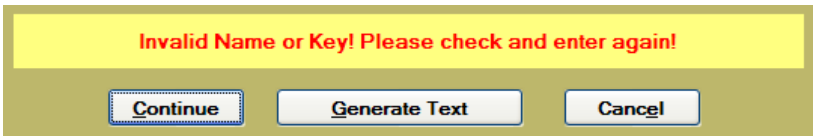
This program will not automatically launch the outlook client since this will not work with online email sites.

18.6.2.2 Steps for USER after receiving a License Key

Once the USER receives an email from the ADMINISTRATOR of the application, the USER can start the application again.

The License form will appear and the USER will enter the License Name and License Key text exactly as it appears from the email. The USER will then press the CONTINUE button to validate the text and continue to the main form.

The USER must enter a License name that they want associated with the application. Otherwise, an error message appears.

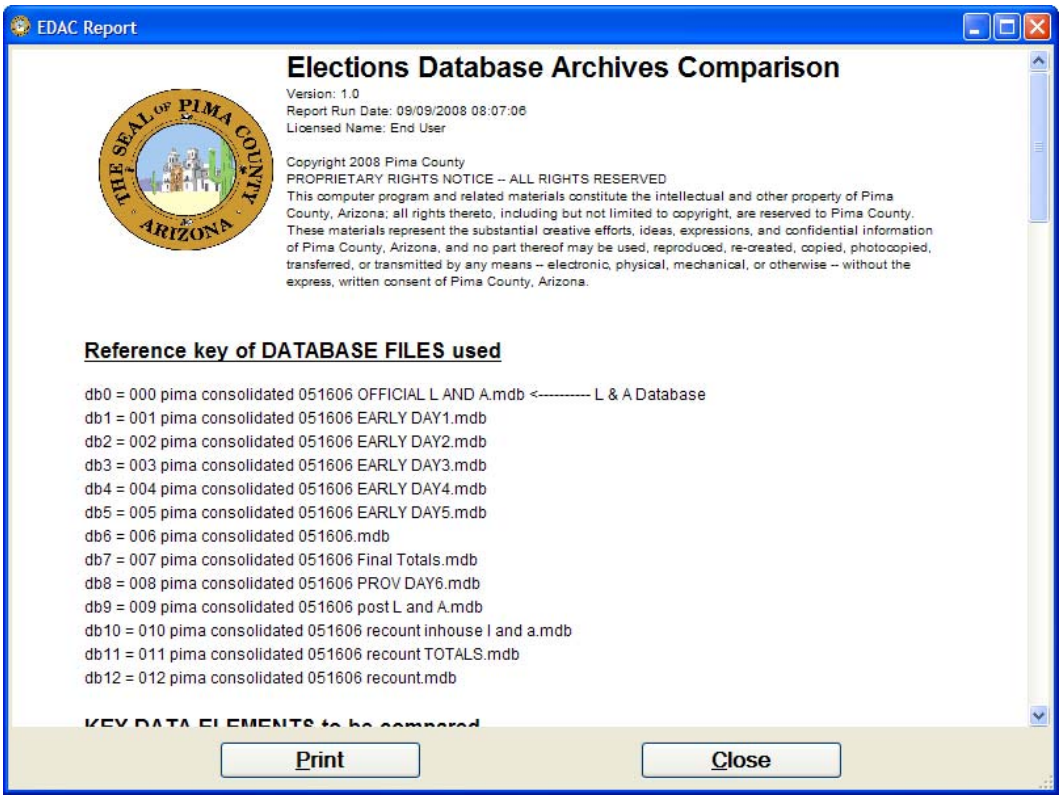


18.7 USER Report Specifications

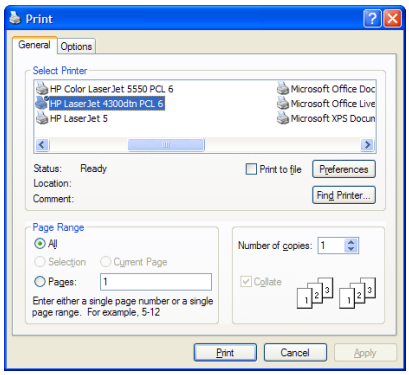
From the main form, clicking on the SHOW REPORT button will analyze the databases and generate an onscreen report.

The outcome of the database comparison results are displayed in a HTML report that includes the following sections:

- Header (See 18.7.2)
- Reference Key of MDB databases files compared (See 18.7.3)
- Key Legend of all key data elements to be compared (See 18.7.4)
- Table matrix showing results (See 18.7.5)
- List of discrepancies, if any (See 18.7.6)



18.7.1 Print / Close Actions



Clicking the PRINT button brings up the Windows print dialog box where you can choose which printer to send the output to. Clicking on this PRINT button will send the output to the printer.

The CLOSE button will exit this form and return the user back to the main screen.

18.7.2 Header Section

The title of the report will identify the following information:

- Title of the program
- Version of the program
- Date and time that the report was run
- The Licensed Name as defined through the Licensing process (See "18.6.2 License Screen Specification")
- Copyright information

Elections Database Archives Comparison

Version: 1.0
Report Run Date: 09/09/2008 08:07:06
Licensed Name: End User

Copyright 2008 Pima County
PROPRIETARY RIGHTS NOTICE -- ALL RIGHTS RESERVED
This computer program and related materials constitute the intellectual and other property of Pima County, Arizona; all rights thereto, including but not limited to copyright, are reserved to Pima County. These materials represent the substantial creative efforts, ideas, expressions, and confidential information of Pima County, Arizona, and no part thereof may be used, reproduced, re-created, copied, photocopied, transferred, or transmitted by any means -- electronic, physical, mechanical, or otherwise -- without the express, written consent of Pima County, Arizona.

18.7.3 List of Databases Section

The databases shown in the database section is from the USER browsed folder from the main screen (see "18.6.1 Main Screen Specifications").

The list of databases will be assigned a key (db0, db1 etc) and list the physical filename of the MDB files that will used for the comparison.

The first database (db0) will always be the SET database and the remaining databases will be listed in alphabetic order.

Reference key of DATABASE FILES used

db0 = 000 pima consolidated 051606 OFFICIAL L AND A.mdb <---------- L & A Database
db1 = 001 pima consolidated 051606 EARLY DAY1.mdb
db2 = 002 pima consolidated 051606 EARLY DAY2.mdb
db3 = 003 pima consolidated 051606 EARLY DAY3.mdb
db4 = 004 pima consolidated 051606 EARLY DAY4.mdb
db5 = 005 pima consolidated 051606 EARLY DAY5.mdb
db6 = 006 pima consolidated 051606.mdb
db7 = 007 pima consolidated 051606 Final Totals.mdb
db8 = 008 pima consolidated 051606 PROV DAY6.mdb
db9 = 009 pima consolidated 051606 post L and A.mdb
db10 = 010 pima consolidated 051606 recount inhouse l and a.mdb
db11 = 011 pima consolidated 051606 recount TOTALS.mdb
db12 = 012 pima consolidated 051606 recount.mdb

18.7.4 Key Data Elements Used Section

The Key Data Elements shown in this section from the preferences.xml file (See "18.8.1 Preferences.XML") and from the checked Key Data Elements from the main screen (see "18.6.1 Main Screen Specifications").

The list of Key Data Elements will be assigned a key (k0, k1 etc) and are grouped by tables first, then by individual fields.

KEY DATA ELEMENTS to be compared

K0 = Ballot
K1 = BallotRot
K2 = BallotRotCardRotPlateRot
K3 = BallotRotRaceRot
K4 = BaseunitBallotRot
K5 = Candidate
K6 = CandVGroup
K7 = Card
K8 = CardRot
K9 = District
K10 = Plate
K11 = PlateHeader
K12 = PlateRace
K13 = PlateRot
K14 = Race
K15 = VGroup
K16 = Preference/KeyID/20/card layout
K17 = Preference/KeyID/21/card suto layout
K18 = Preference/KeyID/25/margins
K19 = Preference/KeyID/50/AccuVote parameters
K20 = Preference/KeyID/55/ABasic report name
K21 = Preference/KeyID/60/card precinct ID
K22 = Preference/KeyID/140/card precinct ID

18.7.5 Comparison Results Table Section

The Key Data Elements of the SET database (db0) will be compared to every other database file (db1 … db99) and will be identified if the values Match ("Y") or are Different ("N"). If the fields or values do not exist, an error is reported ("E").

Specifically, the SET database will always be referenced as DB0 and every other database will be compared against DB0.

If there are over 25 Key Data Elements to compare, the table will be split into multiple tables. This allows the capability to print to hardcopy and retain its formatting.

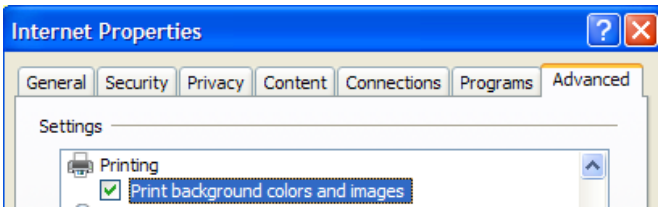
Comparison Results

	K0	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22	Result
db0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
db1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Different
db6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Different
db7	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Different
db8	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Different
db9	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Different
db10	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Different
db11	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Different
db12	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Different

Example of an error

2	K13	K14	K15	K
	-	E	-	
	Y	E	Y	
	Y	E	Y	
	Y	E	Y	
	Y	E	Y	
	Y	E	Y	

Option: For the background shading to show up on the hardcopy version of the output, the user must manually change the Internet Properties, under Advanced tab, the 'Print background colors and images' to be checked.



18.7.6 If any, List of discrepancies

This section is only displayed if there are any database differences when compared against the SET database. This section will list the relevant detailed information of those Key Data Elements that have "NOT Matched".

The detailed information will list the:

- Sequence number of the Not Matched listing
- database name and Legend key
- Table name and Legend key
- Field Name
- Record row number of the table
- The listing of the value of the db0 and the Not Matched database field

Detail Information of NOT Matched values

No.	Database Name	Table Name	Field Name	Num of Row
1	005 pima consolidated 051606 EARLY DAY5.mdb - db5	Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db5 = 'REGIONAL TRANSPORTATION PLAN'		
2	005 pima consolidated 051606 EARLY DAY5.mdb - db5	Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db5 = 'REGION TRANSPORTATION TAX'		
3	006 pima consolidated 051606.mdb - db6	Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db6 = 'REGIONAL TRANSPORTATION PLAN'		
4	006 pima consolidated 051606.mdb - db6	Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db6 = 'REGION TRANSPORTATION TAX'		
5	007 pima consolidated 051606 Final Totals.mdb - db7	Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db7 = 'REGIONAL TRANSPORTATION PLAN'		
6	007 pima consolidated 051606 Final Totals.mdb - db7	Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db7 = 'REGION TRANSPORTATION TAX'		
7	008 pima consolidated 051606 PROV DAY6.mdb - db8	Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db8 = 'REGIONAL TRANSPORTATION PLAN'		
	008 pima consolidated 051606 PROV DAY6.mdb -			

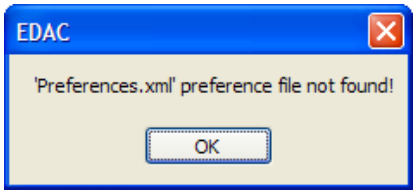
The section will list only the first 1,000 differences and display the following notice:

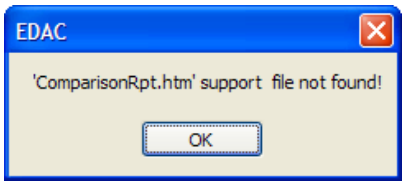
Detail Information of NOT Matched values

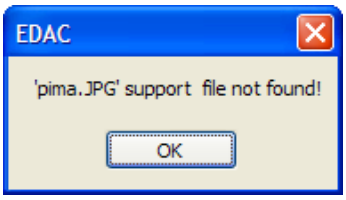
Note: Maximum 1000 Not Match Information displayed here! More ERRORS possible!

18.8 USER Support Files

The EDAC.exe application requires the following files to run: preferences.xml, ComparisonRpt.htm, and the Pima.gif image file. If these support files do not exist in the same folder that the application is run from, then an error message appears and the application will exit.







18.8.1 Preferences.XML

The preferences file is constructed in the Extensible Markup Language (XML) which is a general-purpose specification for creating custom markup languages. It is classified as an extensible language because it allows users to define their own elements and is designed to be relatively human-legible.

18.8.1.1 Sample Preferences Support File

Below is an example of that a preferences.XML may look like:

```
<!-- 2008 Pima County

PROPRIETARY RIGHTS NOTICE - ALL RIGHTS RESERVED

This computer program and related materials constitute the intellectual
and other property of Pima County, Arizona; all rights thereto, including
but not limited to copyright, are reserved to Pima County.  These materials
represent the substantial creative efforts, ideas, expressions, and
confidential information of Pima County, Arizona, and no part thereof may
be used, reproduced, re-created, copied, photocopied, transferred, or
transmitted by any means - electronic, physical, mechanical, or
otherwise - without the express, written consent of Pima County, Arizona.-->
<Preferences>
  <KeyDataElement>
        <TableName>Race</TableName>
        <TableName>CandVGroup</TableName>
        <TableName>Candidate</TableName>
        <TableName>VGroup</TableName>
        <TableName>District</TableName>
        <TableName>BaseunitBallotRot</TableName>
        <TableName>BallotRot</TableName>
        <TableName>Ballot</TableName>
        <TableName>CardRot</TableName>
        <TableName>Card</TableName>
        <TableName>PlateRot</TableName>
        <TableName>Plate</TableName>
        <TableName>PlateRace</TableName>
        <TableName>PlateHeader</TableName>
        <TableName>BallotRotCardRotPlateRot</TableName>
        <TableName>BallotRotRaceRot</TableName>
        <FieldName>Preference/KeyID/20/card layout</FieldName>
        <FieldName>Preference/KeyID/21/card suto layout</FieldName>
        <FieldName>Preference/KeyID/25/margins</FieldName>
        <FieldName>Preference/KeyID/50/AccuVote parameters</FieldName>
        <FieldName>Preference/KeyID/55/ABasic report name</FieldName>
        <FieldName>Preference/KeyID/60/card precinct ID</FieldName>
        <FieldName>Preference/KeyID/140/card precinct ID</FieldName>
   </KeyDataElement>

  < DataBaseNameKeyWord >POST</ DataBaseNameKeyWord >
  <LAKeyWord>LNA</LAKeyWord>

  <HardwareID>..CN137404CQ023B.</HardwareID>

  <Licensename>End User</Licensename>
  <LicenseKey>3AE8B4F4C943FA61E57D5F933179B73B</LicenseKey>

  <Email>elections.administrator@pima.gov</Email>

  <Instruction>Thank you for using the Elections Database Archives Comparison (EDAC) application. You must first license this
      software. Send an email to elections.administrator@pima.gov with the following information and a license key will be
      returned. Please allow up to two business days, excluding holidays, for processing.</Instruction>
</Preferences>
```

There are certain XML elements that are defined and used by the application and are listed below:

18.8.1.2 <KeyDataElement> XML element

A list of key data elements that are used for configuration and setting the parameters for an election will be stored in an external preferences file. This will allow users the capability to add or remove Key Data Elements when necessary. The source of the initial list of Key Data Elements came from the vendor (See “18.5 Actual Key Data Elements”).

If the name specified is not a valid key data element, then the report will show an “E” for error.

When a TABLE name is identified as a Key Data Element, then all rows and columns are compared from the SET database to all other databases.

For example: <TableName>Race</TableName>

When a TABLE, FIELDNAME and VALUE are identified as a Key Data Element, then that single value of the SET database is compared against all other databases. The forward slash (/) is used as the delimiter between each item.

For example: <FieldName>Preference/KeyID/20/card layout</FieldName>
would look at the *Preference* table in the column name called *KeyID* with a value of *20* and compare the remaining column(s) from the SET database against all other databases. The remaining text is a comment for readability and not used in the actual comparison analysis.

18.8.1.3 <DataBaseNameKeyWord> XML element

Archived backups are performed throughout an election process. This application is only concerned with the SET database and all archived backups since the SET database.

The folder may contain archived backups prior to the SET database that will not be used in the comparison process. As per the "18.3 Database Standard Naming Convention" section, Element #5 will have specific words describing the time frame of the backup.

Only the SET and backups after the SET database will be loaded and compared.

For example: <DataBaseNameKeyWord>POST</ DataBaseNameKeyWord >
would look at all databases in the user specified folder containing the word "POST" as the #5 filename element.

Note: The application looks at the words after the #4 element. The #4 element is considered the second set of numbers. The #5 element will look immediately after the #4 element.

18.8.1.4 <LAKeyWord> XML element

The folder may contain archived backups prior to the SET database that will not be used in the comparison process. As per the "18.3 Database Standard Naming Convention" section, Element #5 will have specific words describing the time frame of the backup.

Only the SET and backups after the SET database will be loaded and compared.

For exmaple: <LAKeyWord>LNA</LAKeyWord>
would look at all databases in the user specified folder containing the word "LNA" as the #5 filename element.

Note: The application looks at the words after the #4 element. The #4 element is considered the second set of numbers. The #5 element will look immediately after the #4 element.

18.8.1.5 Licensing Information XML elements

The combination of the following three XML elements are used to determine if the application is licensed to run on the specific computer and if the application is properly license through the ADMINISTRATOR. (See "18.1.7 Licensing").

Warning: Do not modify these values. These values are updated by the application.

```
<HardwareID>1234567890abcdefg</HardwareID>
<Licensename>End User</Licensename>
<LicenseKey>1A2B3C4DC943FA61E57D5F933179B73B</LicenseKey>
```

18.8.1.6 Settings XML elements

The following elements are used by the application for instructions to the USER when submitting the request for a License Key. Instructions can be modified without the need to recompile the application. The email element is the destination email address that the ADMINISTRATOR will monitor for requests for License Keys.

<Email>elections.administrator@pima.gov</Email>
<Instruction>Thank you for using the Elections Database Archives Comparison (EDAC) application. You must first license this software. Send an email to elections.administrator@pima.gov with the following information and a license key will be returned. Please allow up to two business days, excluding holidays, for processing.</Instruction>

18.8.2 ComparisonRpt.htm

This supporting file is the template for the report and is required. Any change in the HTM source code will have unpredictable results. Do not make changes to this support file. The application performs a substitution with the “id” tags throughout the file and replaces the “id” tags with actual data.

18.8.3 Pima.gif

This supporting file is only used for the HTM report to provide the graphic image. Do not make changes to this support file.

18.9 ADMINISTRATOR Screen Specifications

EDAC_KeyGenerator.exe is only used by the ADMINISTRATOR to generate the License Key based upon the information provided by the USER. (See "18.1.7 Licensing").

This application must be kept in a secure location and can not be distributed.

The USER will request a License Key and provide, at the minimum, a Hardware ID and a License Name. (See "18.6.2.1 Steps if USER does not have a License Key")

18.9.1.1 Step 1, Validate Received USER Information

Validate that the License Name is valid and that all additional information if provided. If additional information is required, then the ADMINISTRATOR will contact the USER before providing a License Key.

18.9.1.2 Step 2, Enter License Information

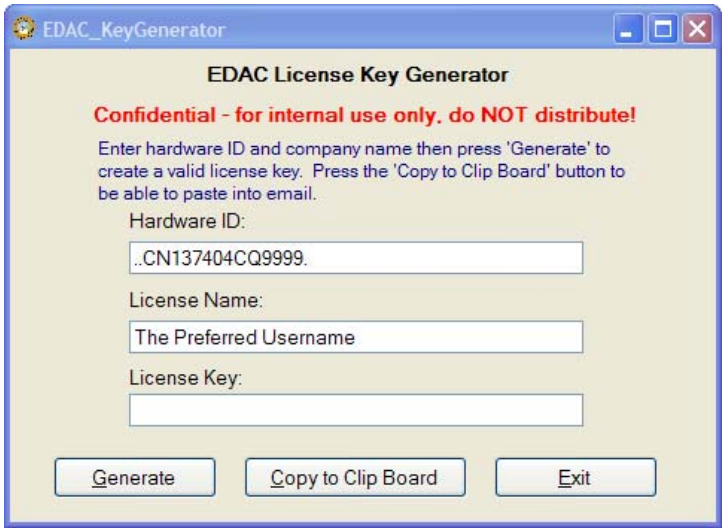
From the email received from the USER, the Hardware ID (HID) and License Name can be copied and pasted into the Key Generator one line at a time.

Example of text that is received from the USER:

```
Software: EDAC
Version: 1.0
HID: ..CN137404CQ9999.
License Name: The Preferred Username
```

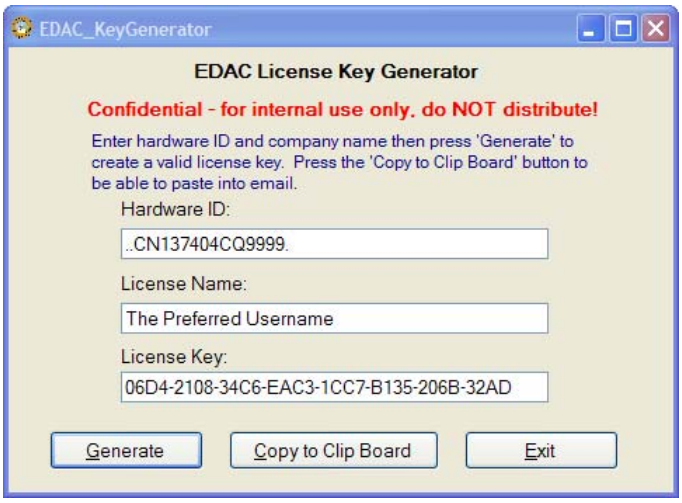
For the Hardware ID, make sure to include all characters, including punctuation (i.e. periods, etc) are included. If this information is incorrect, then the License Key will not work for the USER.

The ADMINISTATOR has the option to change, with discretion, the License Name. Note: the License Name is case sensitive.



18.9.1.3 Step 3, Generate License Key

From the example above, clicking on the "Generate" button will create a valid License Key based upon the Hardware ID and the License Name.



18.9.1.4 Step 4, Send License Information to the USER

From the example above, clicking on the "Copy to Clip Board" will take the three values and place them in the Windows Clipboard to allow pasting to the email to the USER.

Example of text that is sent to the USER:

```
Hardware ID: ..CN137404CQ9999.
License Name: The Preferred Username
License Key: 06D4-2108-34C6-EAC3-1CC7-B135-206B-32AD
```

The USER will receive the information and re-run the application to enter the License information (See "18.6.2.2 Steps for USER after receiving a License Key").

Step 5, Record License Information to the Log

A License Log will be used to record all requests and License information. This log is out of scope for this project and will be up to the ADMINISTRATOR to maintain proper records.

19 Testing Procedures

The follow scenarios are a subset of testing that was performed during development and User Acceptance Testing. The subsequent sections validate the logic and programming routines of the application.

19.1 Original Comparison Report – all databases match

The following is the original report showing that all Key Data Elements match between the SET database (dbo) and each sequential database (db1, db2, db3, db4, db5, db6)

Elections Database Archives Comparison

Version: 1.0
Report Run Date: 09/09/2008 08:14:22
Licensed Name: End User

Copyright 2008 Pima County
PROPRIETARY RIGHTS NOTICE -- ALL RIGHTS RESERVED
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Reference key of DATABASE FILES used

db0 = 01 091206-pima primary sos early LNA results.mdb <---------- L & A Database
db1 = 02 091206-pima primary early day1.mdb
db2 = 03 091206-pima primary early day2.mdb
db3 = 04 091206-pima primary early day3.mdb
db4 = 05 091206-pima primary Lates Day 1.mdb
db5 = 06 091206-pima primary provisionals.mdb
db6 = 07 091206-pima primary FINAL TOTALS.mdb

KEY DATA ELEMENTS to be compared

K0 = Ballot
K1 = BallotRot
K2 = BallotRotCardRotPlateRot
K3 = BallotRotRaceRot
K4 = BaseunitBallotRot
K5 = Candidate
K6 = CandVGroup
K7 = Card
K8 = CardRot
K9 = District
K10 = Plate
K11 = PlateHeader
K12 = PlateRace
K13 = PlateRot
K14 = Race
K15 = VGroup
K16 = Preference/KeyID/20/card layout
K17 = Preference/KeyID/21/card suto layout
K18 = Preference/KeyID/25/margins
K19 = Preference/KeyID/50/AccuVote parameters
K20 = Preference/KeyID/55/ABasic report name
K21 = Preference/KeyID/60/card precinct ID
K22 = Preference/KeyID/140/card precinct ID

Comparison Results

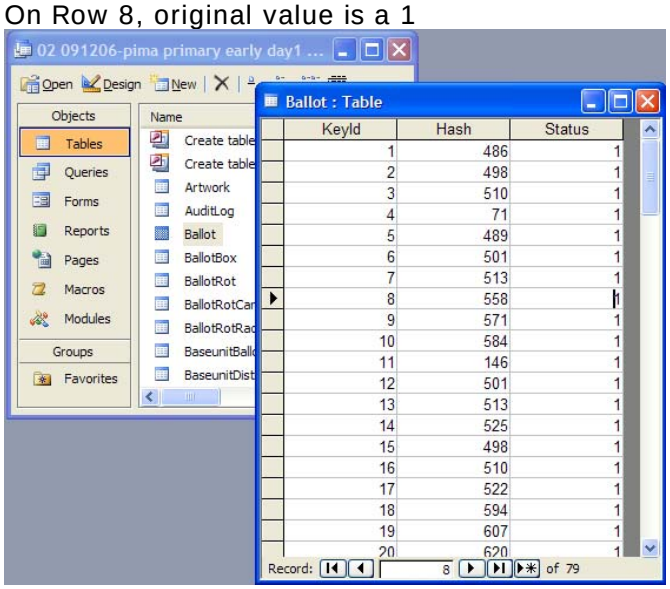
	K0	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22	Result
db0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
db1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match

19.2 Scenario to change: "K0 – Ballot" – One row

On db1, made a change in the Ballot table ROW 8 and changed the value from a 1 to 0.

19.2.1 BEFORE

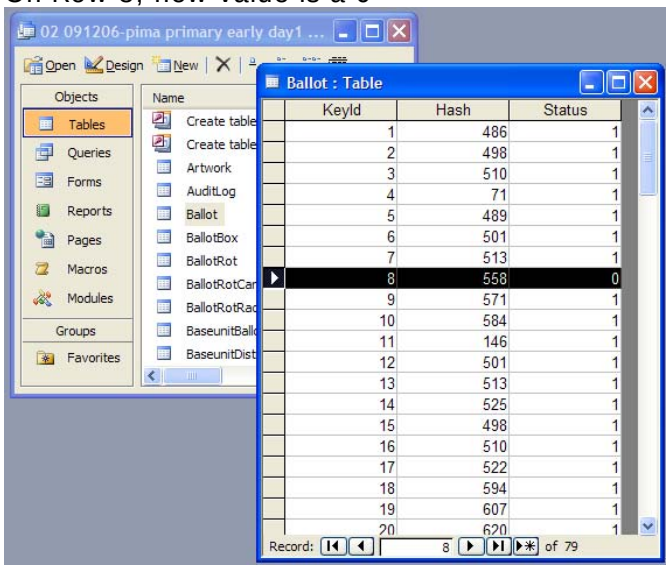
On Row 8, original value is a 1



KeyId	Hash	Status
1	486	1
2	498	1
3	510	1
4	71	1
5	489	1
6	501	1
7	513	1
8	558	1
9	571	1
10	584	1
11	146	1
12	501	1
13	513	1
14	525	1
15	498	1
16	510	1
17	522	1
18	594	1
19	607	1
20	620	1

19.2.2 AFTER

On Row 8, new value is a 0



KeyId	Hash	Status
1	486	1
2	498	1
3	510	1
4	71	1
5	489	1
6	501	1
7	513	1
8	558	0
9	571	1
10	584	1
11	146	1
12	501	1
13	513	1
14	525	1
15	498	1
16	510	1
17	522	1
18	594	1
19	607	1
20	620	1

19.2.3 RESULTS

Comparison report has an "N" under K0 in db1. The "Not Matched" section is shown displaying the Key Data Element that does not match including database, table, field and row number. The SET database value is listed along with the compared database (e.g., db1).

Comparison Results

	K0	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22	Result
db0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
db1	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Different
db2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match

Detail Information of NOT Matched values

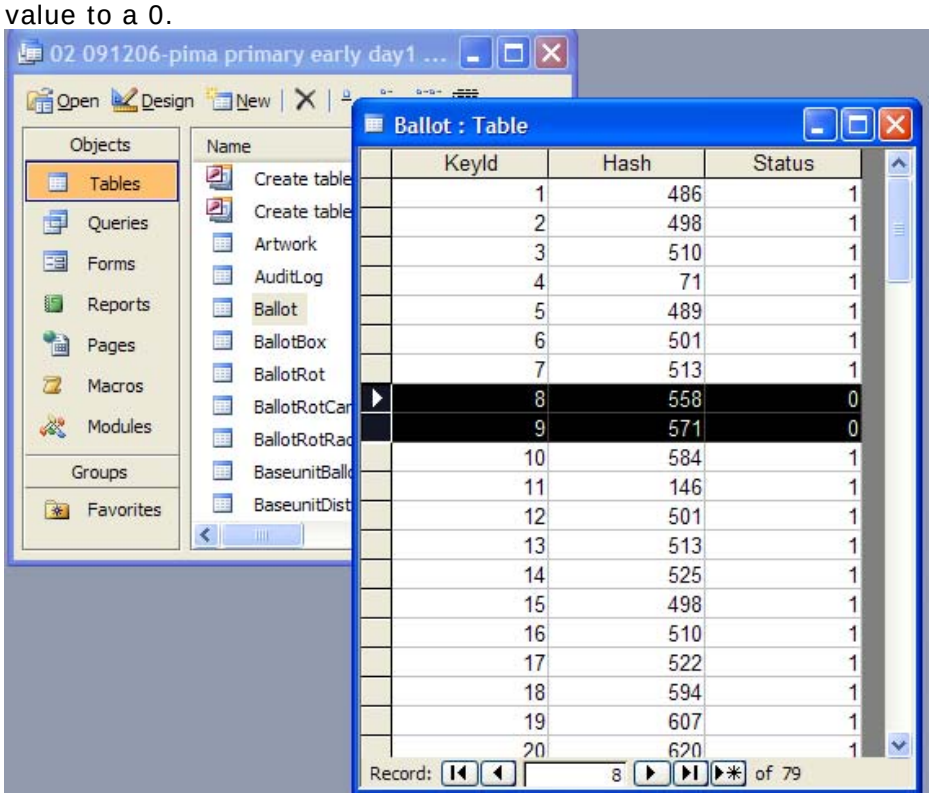
No.	Database Name	Table Name	Field Name	Num of Row
1	02 091206-pima primary early day1.mdb - db1	Ballot - K0	Status	8
	Value	db0 = '1' db1 = '0'		

19.3 Scenario to change: "K0 – Ballot" – Two rows

On db1, made a change in the Ballot table ROW 8 and changed the value from a 1 to 0 and changed ROW 9 from a 1 to a 0. This test represents showing multiple changes per single Key Data Element and see if all changes are listed.

19.3.1 AFTER

Taking the original table values from 19.2.1 above, change both Row 8's value and ROW 9's new value to a 0.



Keyld	Hash	Status
1	486	1
2	498	1
3	510	1
4	71	1
5	489	1
6	501	1
7	513	1
8	558	0
9	571	0
10	584	1
11	146	1
12	501	1
13	513	1
14	525	1
15	498	1
16	510	1
17	522	1
18	594	1
19	607	1
20	620	1

19.3.2 RESULTS

Comparison report has an "N" under K0 in db1. The "Not Matched" section is shown displaying the Key Data Element that does not match including database, table, field and row number. The SET database value is listed along with the compared database (e.g., db1). Both rows from the same Key Data Element are listed.

Comparison Results

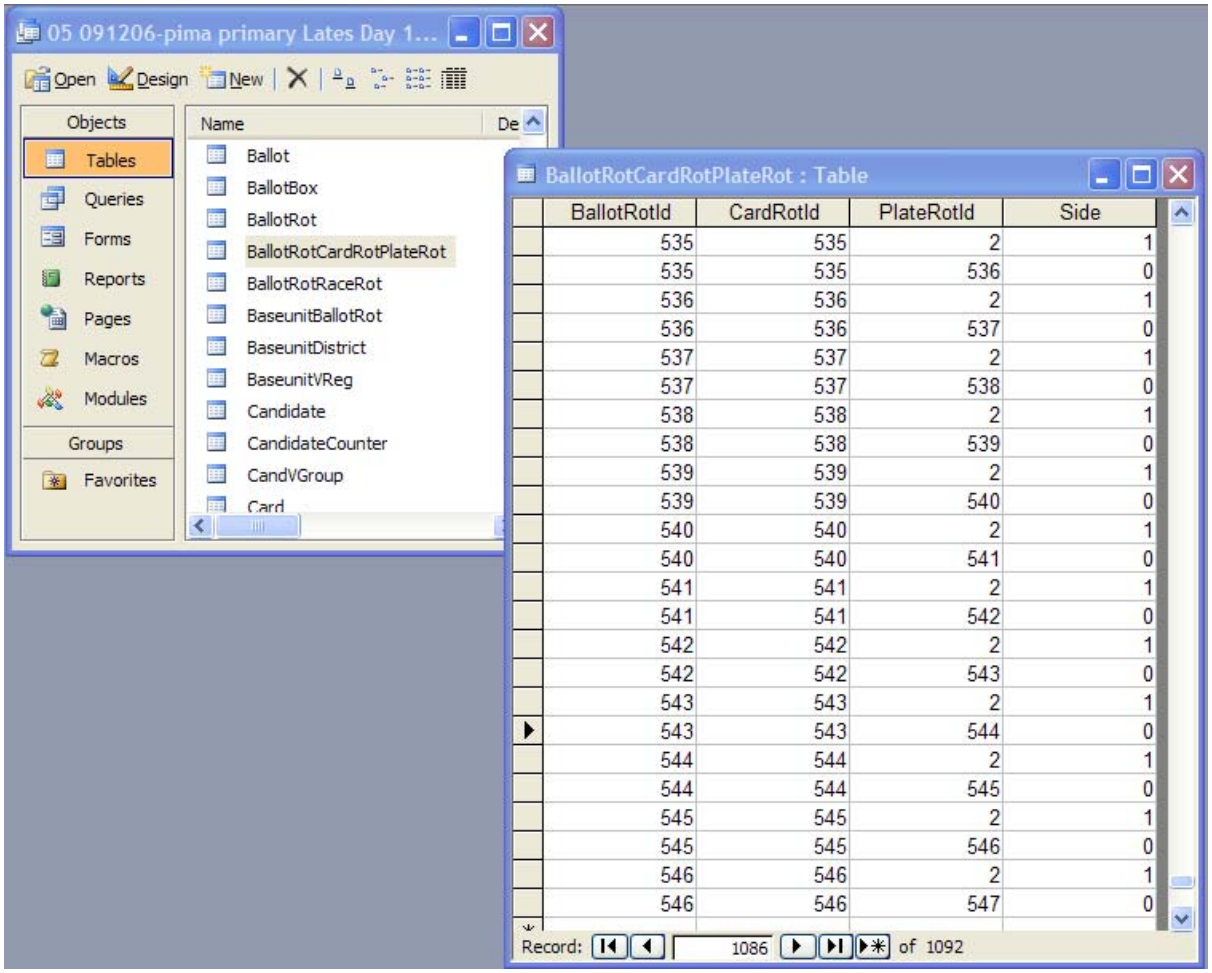
	K0	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22	Result
db0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
db1	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Different
db2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match

Detail Information of NOT Matched values

No.	Database Name		Table Name	Field Name	Num of Row
1	02 091206-pima primary early day1.mdb - db1		Ballot - K0	Status	8
	Value	db0 = '1' db1 = '0'			
2	02 091206-pima primary early day1.mdb - db1		Ballot - K0	Status	9
	Value	db0 = '1' db1 = '0'			

19.4 Scenario to change: "K2 – BallotRotCardRotPlateRot" – Side Value

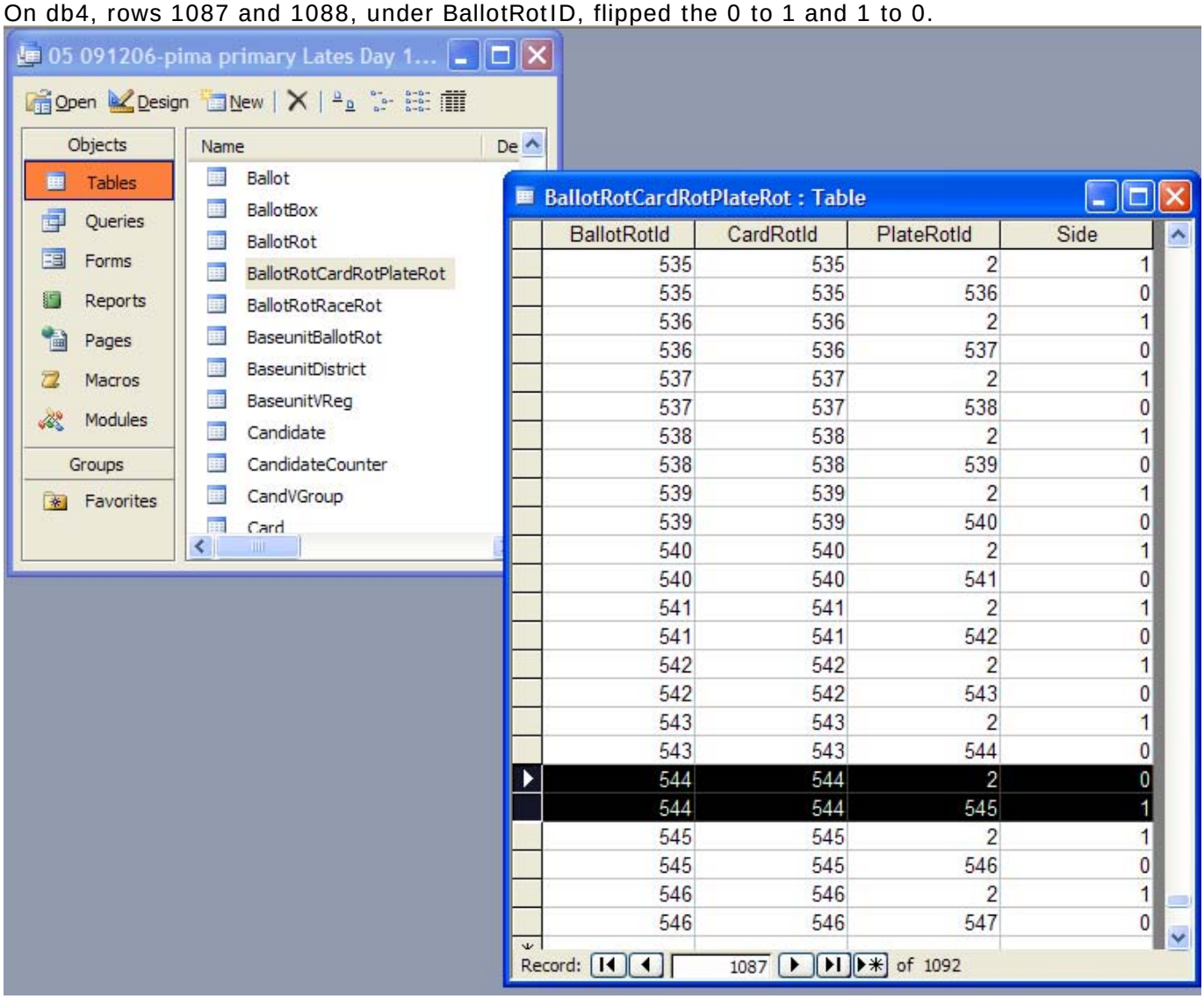
19.4.1 BEFORE



BallotRotId	CardRotId	PlateRotId	Side
535	535	2	1
535	535	536	0
536	536	2	1
536	536	537	0
537	537	2	1
537	537	538	0
538	538	2	1
538	538	539	0
539	539	2	1
539	539	540	0
540	540	2	1
540	540	541	0
541	541	2	1
541	541	542	0
542	542	2	1
542	542	543	0
543	543	2	1
543	543	544	0
544	544	2	1
544	544	545	0
545	545	2	1
545	545	546	0
546	546	2	1
546	546	547	0

19.4.2 AFTER

On db4, rows 1087 and 1088, under BallotRotID, flipped the 0 to 1 and 1 to 0.



BallotRotId	CardRotId	PlateRotId	Side
535	535	2	1
535	535	536	0
536	536	2	1
536	536	537	0
537	537	2	1
537	537	538	0
538	538	2	1
538	538	539	0
539	539	2	1
539	539	540	0
540	540	2	1
540	540	541	0
541	541	2	1
541	541	542	0
542	542	2	1
542	542	543	0
543	543	2	1
543	543	544	0
544	544	2	0
544	544	545	1
545	545	2	1
545	545	546	0
546	546	2	1
546	546	547	0

19.4.3 RESULTS

Comparison Results

	K0	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22	Result
db0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
db1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db4	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Different
db5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match

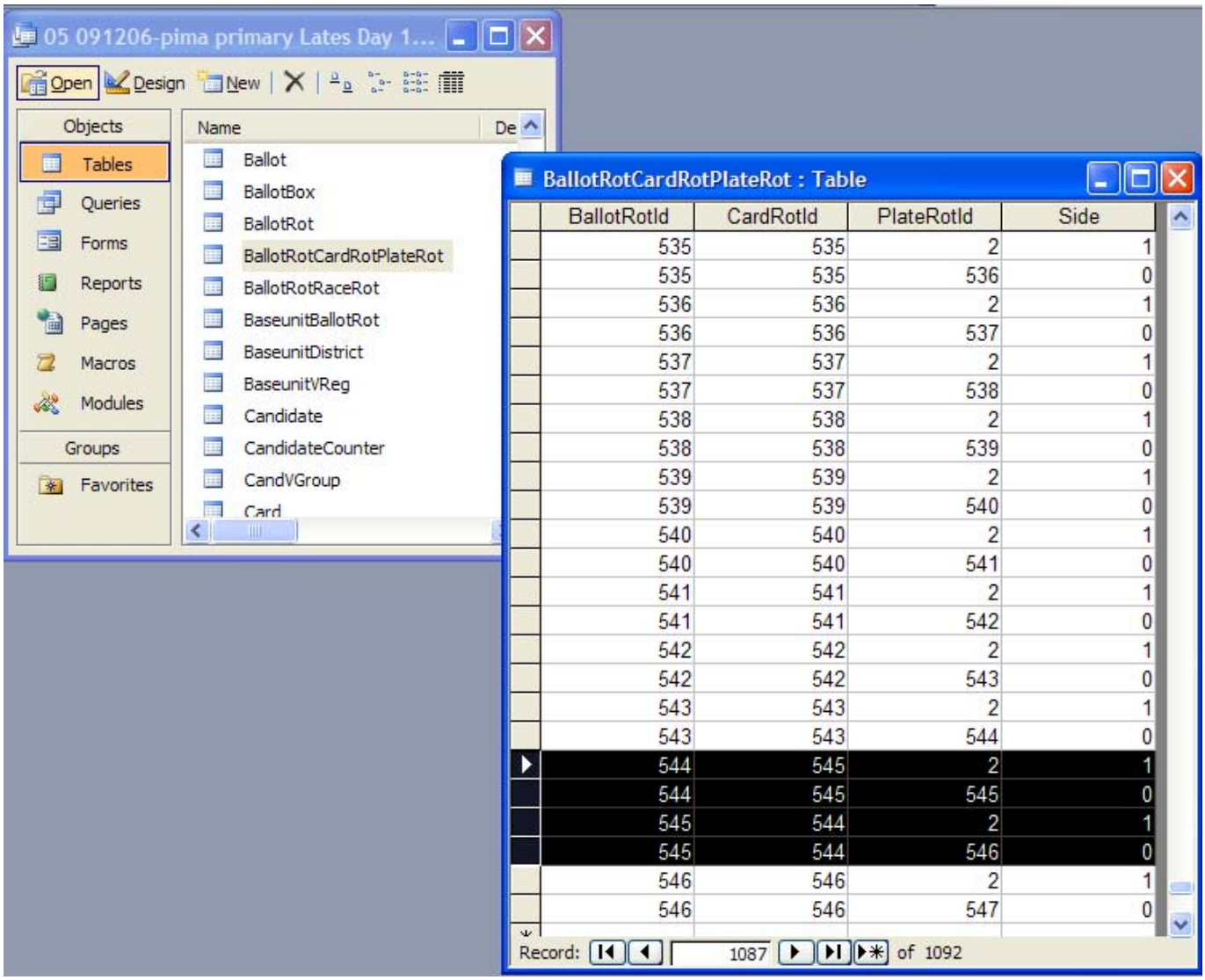
Detail Information of NOT Matched values

No.	Database Name		Table Name	Field Name	Num of Row
1	05 091206-pima primary Lates Day 1.mdb - db4		BallotRotCardRotPlateRot - K2	Side	1087
	Value	db0 = '1' db4 = '0'			
2	05 091206-pima primary Lates Day 1.mdb - db4		BallotRotCardRotPlateRot - K2	Side	1088
	Value	db0 = '0' db4 = '1'			

19.5 Scenario to change: "K2 – BallotRotCardRotPlateRot" – CardRotID

19.5.1 AFTER

Taking the original table values from 19.4.1 above, change rows 1087, 1088, 1089 and 1090 under BallotRotID 544 and 545, changed the pairs of CardRotID column.



BallotRotId	CardRotId	PlateRotId	Side
535	535	2	1
535	535	536	0
536	536	2	1
536	536	537	0
537	537	2	1
537	537	538	0
538	538	2	1
538	538	539	0
539	539	2	1
539	539	540	0
540	540	2	1
540	540	541	0
541	541	2	1
541	541	542	0
542	542	2	1
542	542	543	0
543	543	2	1
543	543	544	0
544	545	2	1
544	545	545	0
545	544	2	1
545	544	546	0
546	546	2	1
546	546	547	0

19.5.2 RESULTS

All changes are represented in the Comparison Report.

Comparison Results

	K0	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22	Result
db0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
db1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db4	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Different
db5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match

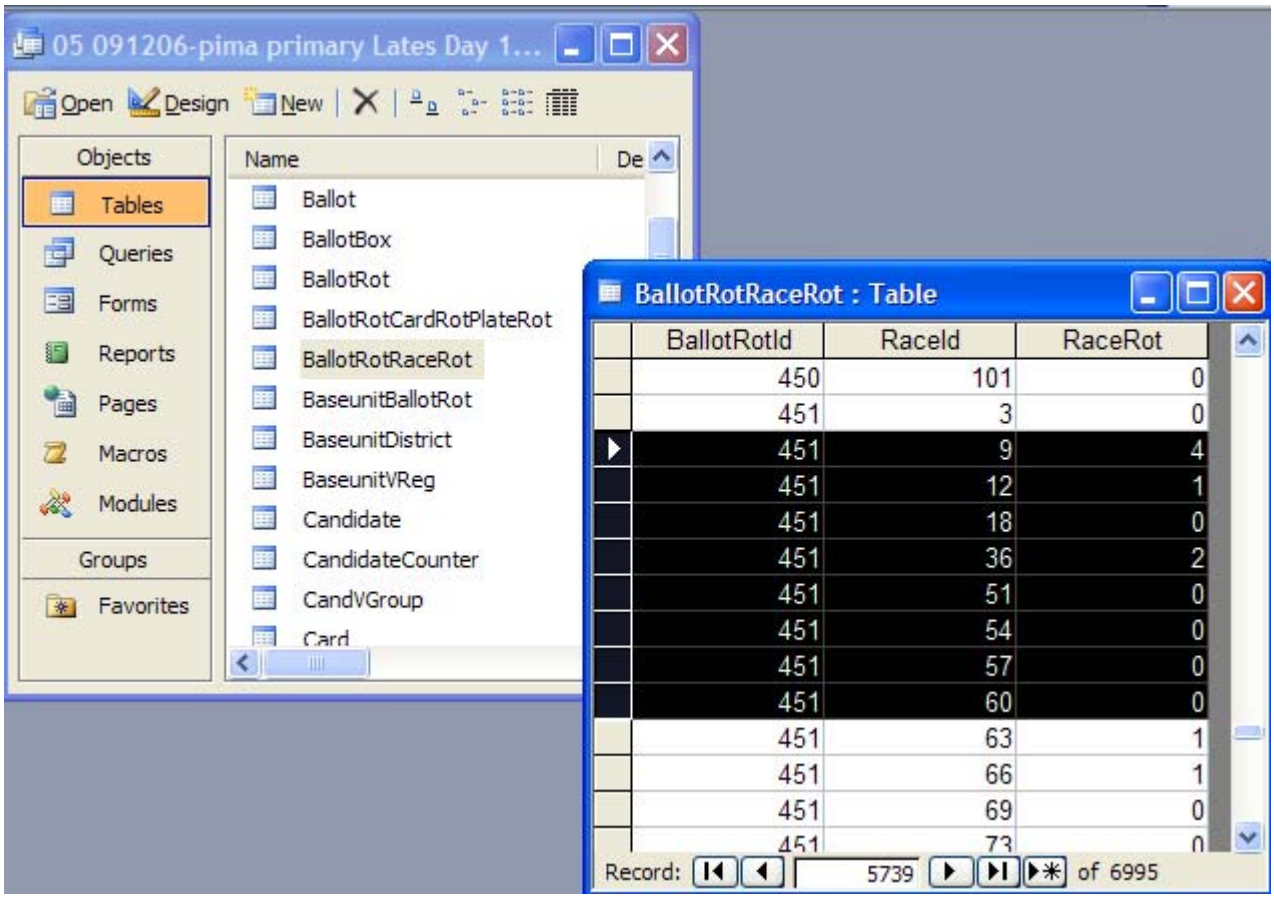
Detail Information of NOT Matched values

No.	Database Name		Table Name	Field Name	Num of Row
1	05 091206-pima primary Lates Day 1.mdb - db4		BallotRotCardRotPlateRot - K2	CardRotId	1087
	Value	db0 = '544' db4 = '545'			
2	05 091206-pima primary Lates Day 1.mdb - db4		BallotRotCardRotPlateRot - K2	CardRotId	1088
	Value	db0 = '544' db4 = '545'			
3	05 091206-pima primary Lates Day 1.mdb - db4		BallotRotCardRotPlateRot - K2	CardRotId	1089
	Value	db0 = '545' db4 = '544'			
4	05 091206-pima primary Lates Day 1.mdb - db4		BallotRotCardRotPlateRot - K2	CardRotId	1090
	Value	db0 = '545' db4 = '544'			

19.6 Scenario to change: "K3 – BallotRotRaceRot"

19.6.1 BEFORE

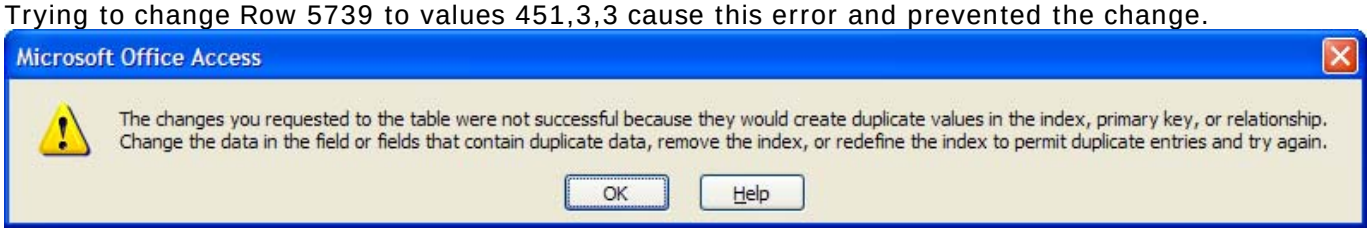
Table BallotRotRaceRot on Row 5739 has values of 451,9,4 and Row 5746 has values of 451, 60,0.



BallotRotId	RaceId	RaceRot
450	101	0
451	3	0
451	9	4
451	12	1
451	18	0
451	36	2
451	51	0
451	54	0
451	57	0
451	60	0
451	63	1
451	66	1
451	69	0
451	73	0

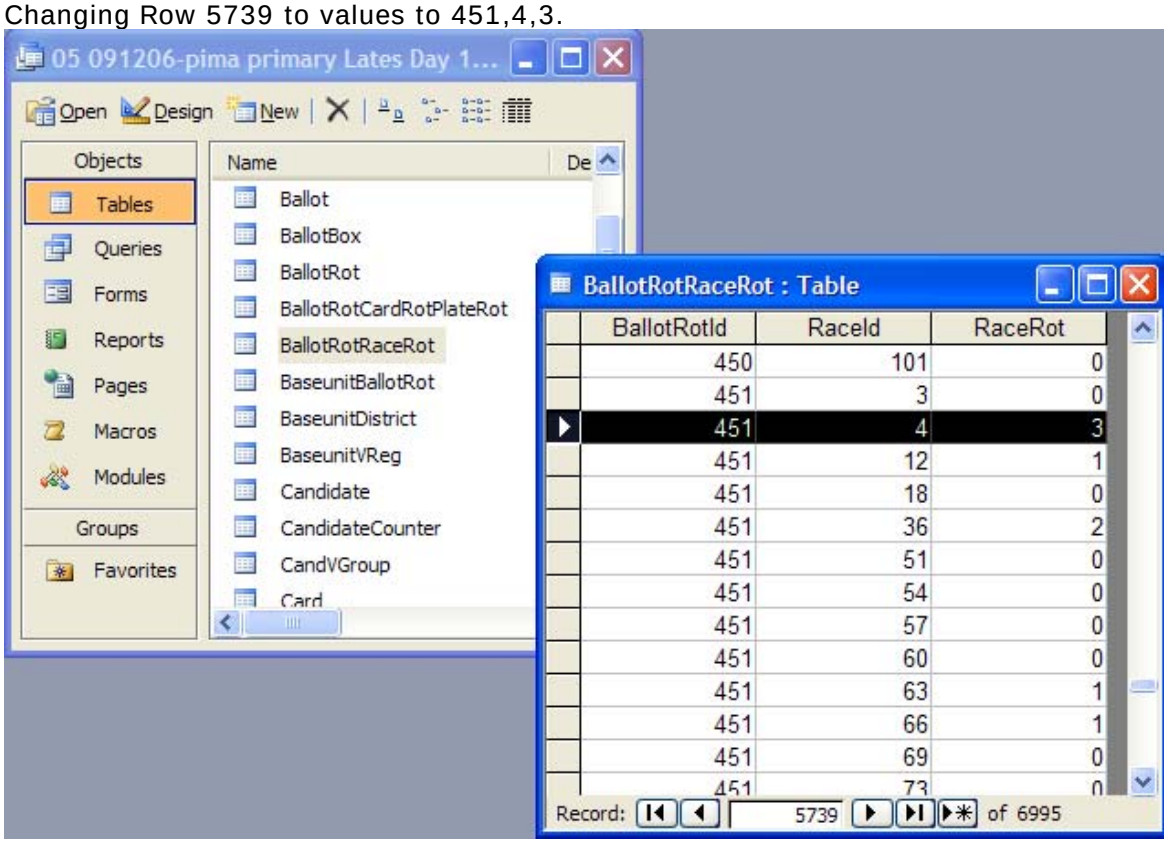
19.6.2 Attempt change error

Trying to change Row 5739 to values 451,3,3 cause this error and prevented the change.



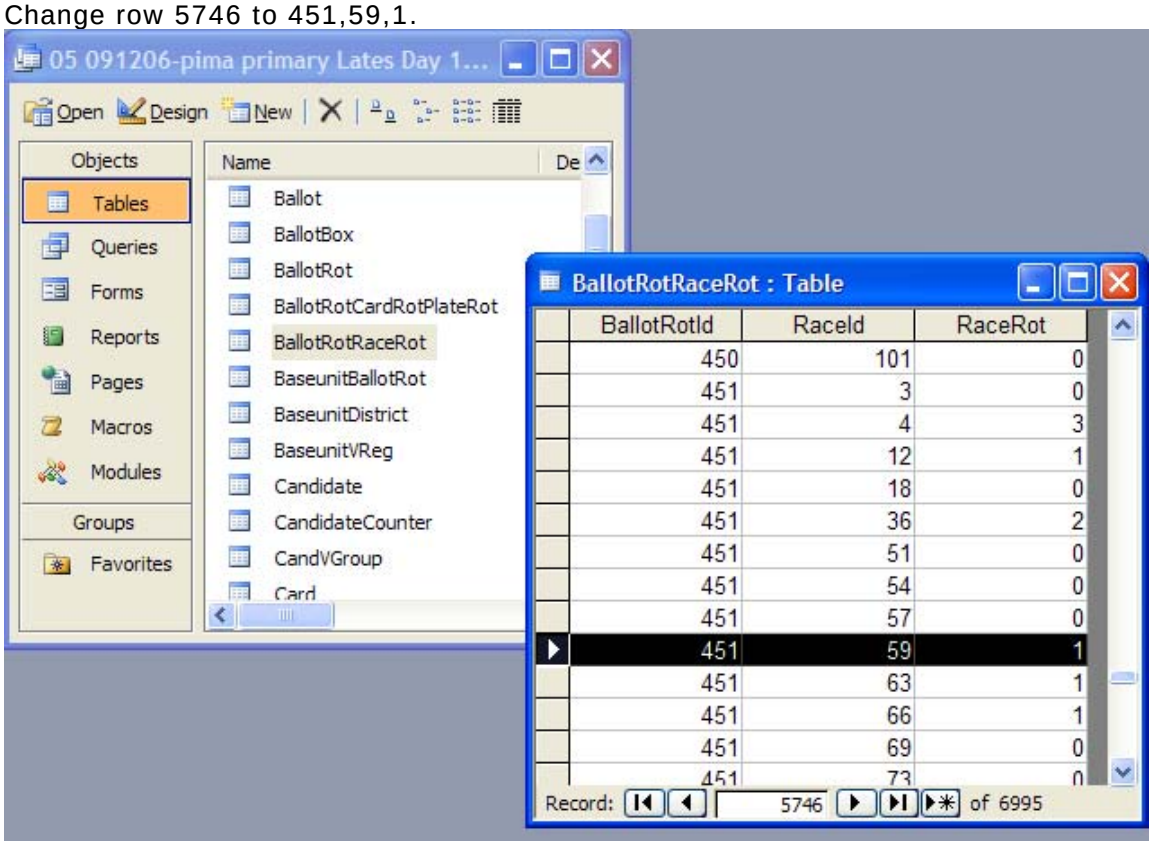
19.6.3 AFTER – Change 1

Changing Row 5739 to values to 451,4,3.



19.6.4 AFTER – Change 2

Change row 5746 to 451,59,1.



19.6.5 RESULTS

Comparison Results

	K0	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22	Result
db0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
db1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db4	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Different
db5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match

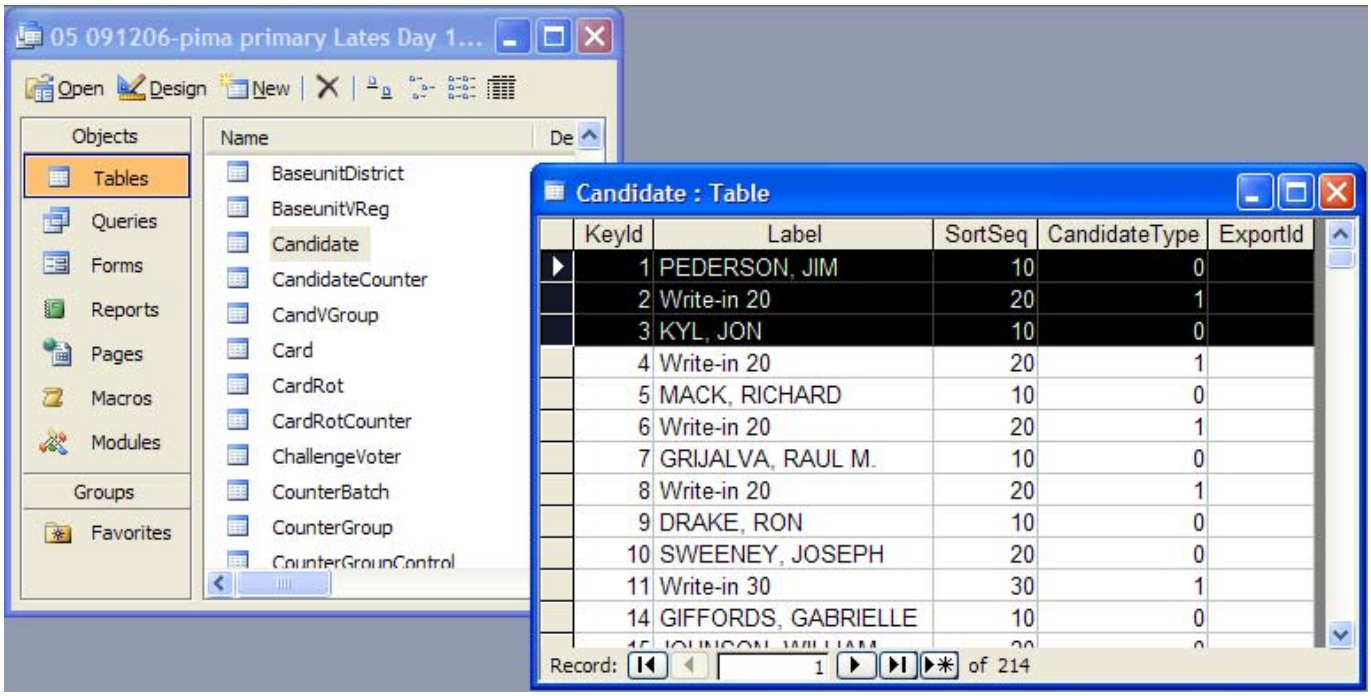
Detail Information of NOT Matched values

No.	Database Name		Table Name	Field Name	Num of Row
1	05 091206-pima primary Lates Day 1.mdb - db4		BallotRotRaceRot - K3	RaceId	5739
	Value	db0 = '9' db4 = '4'			
2	05 091206-pima primary Lates Day 1.mdb - db4		BallotRotRaceRot - K3	RaceRot	5739
	Value	db0 = '4' db4 = '3'			
3	05 091206-pima primary Lates Day 1.mdb - db4		BallotRotRaceRot - K3	RaceId	5746
	Value	db0 = '60' db4 = '59'			
4	05 091206-pima primary Lates Day 1.mdb - db4		BallotRotRaceRot - K3	RaceRot	5746
	Value	db0 = '0' db4 = '1'			

19.7 Scenario to change: "K5 – Candidate"

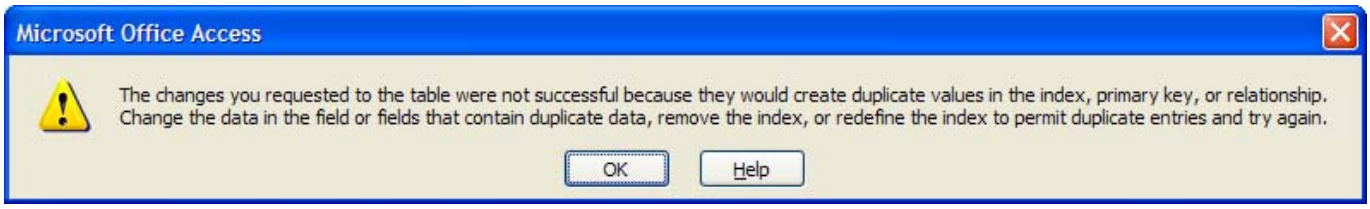
19.7.1 BEFORE

On db4, made a change in the Candidate table Rows 1 and 3.



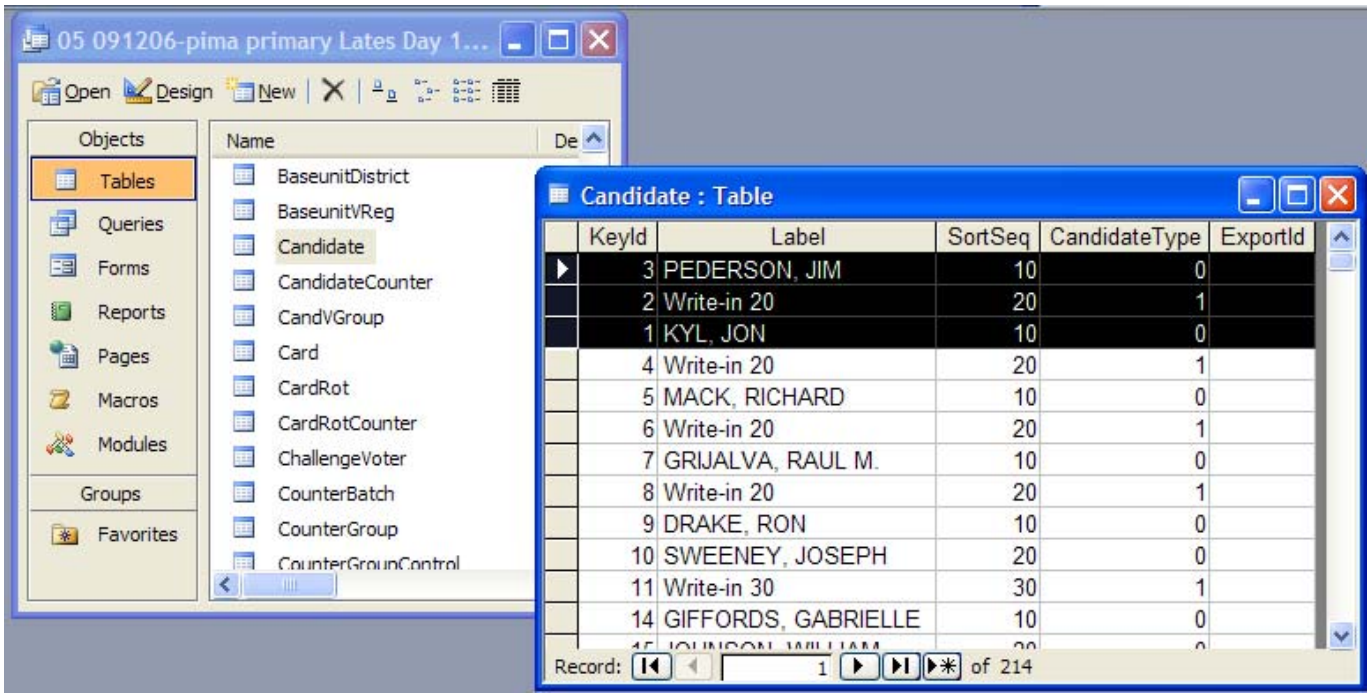
19.7.2 Attempt Change Error

Trying to change Row 1 to a value of 3 caused this error and prevented the change. I had to perform a multiple change to bypass the error.



19.7.3 AFTER

On db4, made a change in the Candidate table Rows 1 and 3 and flipped the candidate KeyID values 1 to a 3 and 3 to a 1.



19.7.4 RESULTS

The results do not show that the KeyID changed, but that the corresponding fields no longer match the SET database, therefore all other non-matched columns will be listed.

Comparison Results

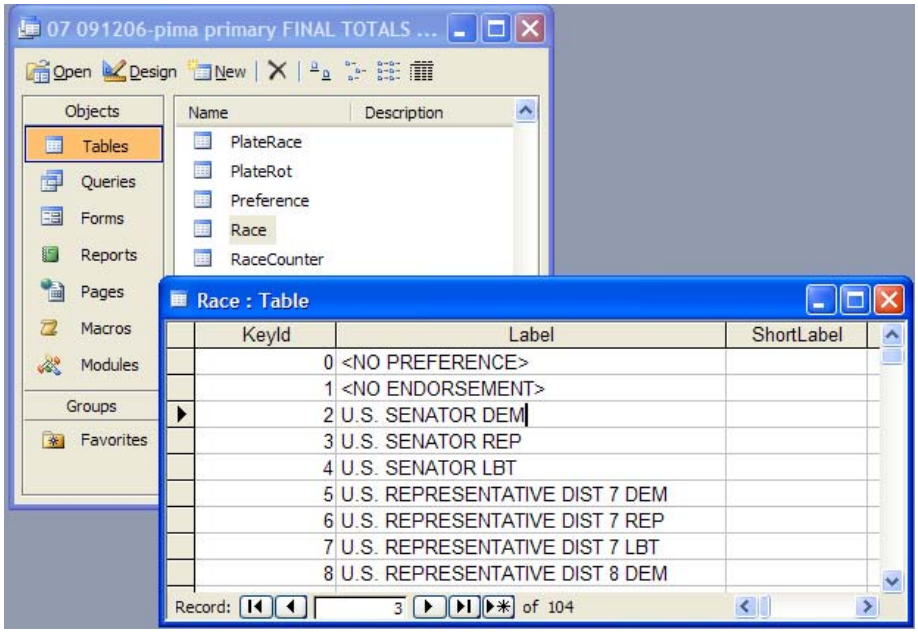
	K0	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22	Result
db0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
db1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db4	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Different
db5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match

Detail Information of NOT Matched values

No.	Database Name		Table Name	Field Name	Num of Row
1	05 091206-pima primary Lates Day 1.mdb - db4		Candidate - K5	Label	1
	Value	db0 = 'PEDERSON, JIM' db4 = 'KYL, JON'			
2	05 091206-pima primary Lates Day 1.mdb - db4		Candidate - K5	Label	3
	Value	db0 = 'KYL, JON' db4 = 'PEDERSON, JIM'			

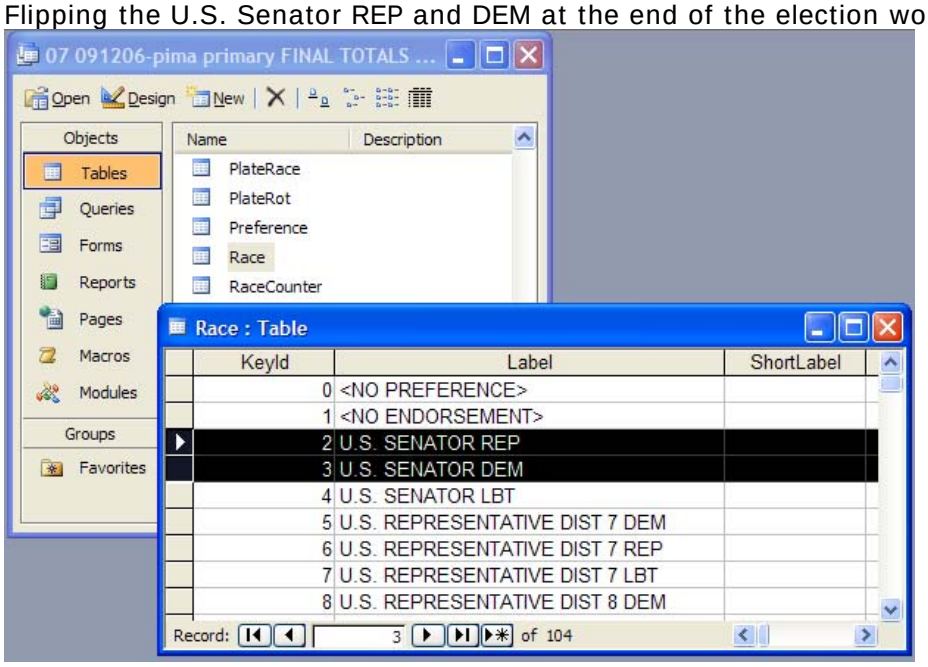
19.8 Scenario to change: "K14 – Race"

19.8.1 BEFORE



19.8.2 AFTER

Flipping the U.S. Senator REP and DEM at the end of the election would look like this:



19.8.3 RESULTS

Comparison Results

	K0	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22	Result
db0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
db1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different

Detail Information of NOT Matched values

No.	Database Name		Table Name	Field Name	Num of Row
1	07 091206-pima primary FINAL TOTALS.mdb - db6		Race - K14	Label	3
	Value	db0 = 'U.S. SENATOR DEM' db6 = 'U.S. SENATOR REP'			
2	07 091206-pima primary FINAL TOTALS.mdb - db6		Race - K14	Label	4
	Value	db0 = 'U.S. SENATOR REP' db6 = 'U.S. SENATOR DEM'			

20 Schedule

20.1 Project Plan Overview

The System Development Life Cycle (SDLC) is intended to provide a set of guidelines for the successful completion of application development projects. The SDLC basically entails five phases that run in sequence. Each phase ends with an outcome/deliverable that requires appropriate authorization and approval by all parties and the project moves onto the next phase.

The first phase is the INITIATION PHASE. In this phase basic information is gathered about the scope of the project. This is when the functionality of the business is observed, feasibility studies are made and a general understanding of the needs are documented. The outcome of this phase is the Initialization Statement of Work (SOW).

The PLANNING PHASE of the SDLC is required to understand and document the users' needs for the system. This Phase will document, in significantly more detail, the scope, business objectives and requirements of the proposed system. The emphasis throughout this Phase is on <u>what</u> the system will do. A schedule of the activities, high and low level tasks, durations, dependencies, resources and timeframes, as well as a listing of the assumptions and constraints are identified. Project resources are allocated and business analysts construct a project schedule with input from management, project sponsors and users to document the formal Project Plan. A Gantt chart is produced to allow tracking progress throughout the project. The detailed technical specifications will be written describing <u>how</u> the proposed system will be built. The outcome of this phase is the Planning Statement of Work (SOW).

The next phase is the EXECUTION PHASE. This is where a software solution may be developed, purchased or upgraded.

If a custom application is to be written, then this Phase deals with the development, unit testing and integration testing of the application modules, screens and reports. In addition, this Phase addresses the preparation and establishment of the technical environment for development, testing and training of user representatives. Any special procedures for data conversion is also developed and tested. This is referred to as Alpha Testing. Adjustments and tweaks may be made to the product being developed as it evolves. The outcome of this phase is the Application as defined in the SOW.

In the CONTROLLING PHASE, system integration testing and end user training occur. This phase actually occurs within the EXECUTION PHASE. At this point, the product is in Beta Testing mode. The business analyst, along with key personnel from the user community, tests the functionality of the product over and over in a controlled environment. Observations are documented during this testing and brought back to the developers or software provider for repair, editing, or adjusting. Once the beta testing is complete the product is considered ready for delivery.

The last phase is the CLOSING PHASE. The closing phase begins with the delivery and formal acceptance of the product by the project sponsor. A post implementation review is conducted to include:

- An assessment of how the project performed against the benefits, objectives, scope, deliverables, schedule, expense and resource targets in the project planning documentation
- A rating of the level of conformance against each of the project processes, including time / cost / quality / change / risk / issue / communications and acceptance management
- A full list of the project achievements

- Lessons learned and recommendations for future projects

20.2 How to read the Project Plan

The project work plan details our path from the Initiation phase to Closure phase. Regular updates to the plan will occur as we move through the project phases. The schedule itself is an estimate and each date in the schedule is estimated. This chart is 'effort' driven and is based upon hours spent on the project. Dates and times will change during the project and the Project Manager will inform the sponsor of any significant changes in the schedule.

The left textual columns represent the Work Breakdown Structure (WBS) defining and organizing the total scope of a project using a hierarchical tree structure focusing on outcomes. The Gantt chart provides the graphical representation of a project schedule. The following pages reflect the Project Plan timeline created in Microsoft's Project. Gantt charts are a common technique for representing the phases, activities and dependencies of a WBS so they can be understood by a wide audience.

20.3 Assumptions

This Project Plan timeline is only an estimate where several assumptions are made.

- All task durations are estimates only and can change at any time
- The developer's time will be available and assigned to this project and may be shared among other projects
- Calendar includes holidays but not staff's time off

20.4 Project Plan Highlights

This project has the following noteworthy milestones:

- #10, Initiation Phase completed on 5/15/2008 and lasted for 43 calendar days
- #17, Planning Phase completed on 6/20/2008 (25 days)
- #27, Original construction of the application was completed on 7/3/2008 (27 days)
- #34, In-house testing and rework of application completed on 7/18/2008 (14 days)
- #35, User acceptance testing
- #45, Implementation Stage
- #57, Acceptance and delivery of final product

20.5 MS-Project Gantt Charts

The detailed Project Plan timeline estimates are listed below:

		% Complete	Task Name	Duration	Start	Finish	lecess
1		65%	**Elections Database Archive Comparison Proje**	**136 days**	**Tue 3/18/08**	**Fri 9/26/08**	
2	✓	100%	**Initiation Phase (I)**	**43 days**	**Tue 3/18/08**	**Thu 5/15/08**	
3	✓	100%	Discovery - Interview Subject Matter Expert	10 days	Tue 3/18/08	Mon 3/31/08	
4	✓	100%	**Complete Initialization Statement of Wc**	**32 days**	**Tue 4/1/08**	**Wed 5/14/08**	**3**
5	✓	100%	General Requirements	32 days	Tue 4/1/08	Wed 5/14/08	
6	✓	100%	Process Flow Diagram	5 days	Thu 5/8/08	Wed 5/14/08	5FF
7	✓	100%	Model Screen	1 day	Wed 5/14/08	Wed 5/14/08	6FF
8	✓	100%	Model Report	1 day	Wed 5/14/08	Wed 5/14/08	7FF
9	✓	100%	Perform Stage-Gate Meeting	1 day	Thu 5/15/08	Thu 5/15/08	4
10	✓	100%	**Initiation Phase (I) Complete**	**0 days**	**Thu 5/15/08**	**Thu 5/15/08**	**2**
11	✓	100%	**Planning Phase (II)**	**25 days**	**Fri 5/16/08**	**Fri 6/20/08**	**10**
12	✓	100%	Create Initial Project Work Plan	1 day	Fri 5/16/08	Fri 5/16/08	
13	✓	100%	Gather Detailed Requirements	5 days	Mon 5/19/08	Fri 5/23/08	12
14	✓	100%	Screen Specifications	5 days	Tue 5/27/08	Mon 6/2/08	13
15	✓	100%	Report Specifications	13 days	Tue 6/3/08	Thu 6/19/08	14
16	✓	100%	Finalize Technical Specs	1 day	Fri 6/20/08	Fri 6/20/08	15
17	✓	100%	**Planning Phase (II) Complete**	**0 days**	**Fri 6/20/08**	**Fri 6/20/08**	**11**
18		53%	**Execution Phase (III)**	**68 days**	**Tue 5/27/08**	**Fri 8/29/08**	
19	✓	100%	**Construction Stage**	**27.5 days**	**Tue 5/27/08**	**Thu 7/3/08**	
20	✓	100%	Create Visual Studio Solution	1 day	Tue 5/27/08	Tue 5/27/08	13
21	✓	100%	SCREEN - MainMenu and logic	8 days	Wed 5/28/08	Fri 6/6/08	20
22	✓	100%	Preferences.xml	0.5 days	Mon 6/9/08	Mon 6/9/08	21
23	✓	100%	REPORT Logic	8 days	Mon 6/9/08	Thu 6/19/08	22
24	✓	100%	ComparisonRpt.htm	1 day	Thu 6/19/08	Fri 6/20/08	23
25	✓	100%	Code Review	4 days	Fri 6/20/08	Thu 6/26/08	24
26	✓	100%	Rework and Retest	5 days	Thu 6/26/08	Thu 7/3/08	25
27	✓	100%	**Construction Stage Complete**	**0 days**	**Thu 7/3/08**	**Thu 7/3/08**	**19**

28	✓	100%	Controlling Phase (IV)	26 days	Fri 6/27/08	Tue 8/5/08	
29	✓	100%	Test Stage - Integration Testing	14 days	Fri 6/27/08	Fri 7/18/08	
34	✓	100%	Test Stage for Presentation Layer (	0 days	Fri 7/18/08	Fri 7/18/08	29
35	✓	100%	Testing Stage - User Acceptance Te	12 days	Fri 7/18/08	Tue 8/5/08	34
36	✓	100%	Verify User Acceptance Readiness	1 day	Fri 7/18/08	Mon 7/21/08	34
37	✓	100%	User Acceptance Testing #1	11 days	Fri 7/18/08	Mon 8/4/08	
38	✓	100%	Document Observations	10 days	Fri 7/18/08	Fri 8/1/08	34
39	✓	100%	System Rework and Retest	1 day	Fri 8/1/08	Mon 8/4/08	38
40	✓	100%	User Acceptance Testing #2	1 day	Mon 8/4/08	Tue 8/5/08	
41	✓	100%	Redo File Processing	1 day	Mon 8/4/08	Tue 8/5/08	39
42	✓	100%	System Rework and Retest	0 days	Tue 8/5/08	Tue 8/5/08	41
43	✓	100%	Testing Stage UAT Complete	0 days	Tue 8/5/08	Tue 8/5/08	35
44	✓	100%	Controlling Phase (IV) Complete	0 days	Tue 8/5/08	Tue 8/5/08	28
45	✓	100%	Implementation Stage	9.5 days	Thu 7/31/08	Wed 8/13/08	
46	✓	100%	Update Planning-Statement of Work	2 days	Thu 7/31/08	Fri 8/1/08	
47	✓	100%	Create and Test Installation Package	6 days	Tue 8/5/08	Wed 8/13/08	40
48		0%	Implementation Stage Complete	0 days	Wed 8/13/08	Wed 8/13/08	45
49		0%	SOW review	20 days	Mon 8/4/08	Fri 8/29/08	46
50		0%	Outstanding Items	10 days	Wed 8/13/08	Wed 8/27/08	
51		0%	elections.administrator@pima.gov	4 days	Wed 8/13/08	Tue 8/19/08	48
52		0%	Define person for Admin role (Licenses)	1 day	Wed 8/13/08	Thu 8/14/08	48
53		0%	Source Code Review	10 days	Wed 8/13/08	Wed 8/27/08	48
54		0%	Copyright Text	10 days	Wed 8/13/08	Wed 8/27/08	48
55		0%	Implementation Strategy Meeting	10 days	Wed 8/13/08	Wed 8/27/08	48
56		0%	Perform Stage-Gate Meeting	1 day	Tue 9/2/08	Tue 9/2/08	18
57		0%	Formal acceptance of software solution	0 days	Tue 9/2/08	Tue 9/2/08	56
58		0%	Execution Phase (III) Complete	0 days	Tue 9/2/08	Tue 9/2/08	57
59		0%	Closing Phase (IV)	18 days	Wed 9/3/08	Fri 9/26/08	58
60		0%	Perform Project Closure	5 days	Wed 9/3/08	Tue 9/9/08	
61		0%	Review Project Completion	10 days	Wed 9/10/08	Tue 9/23/08	60
62		0%	Lessons Learned	3 days	Wed 9/24/08	Fri 9/26/08	61
63		0%	Closing Phase (IV) Complete	0 days	Fri 9/26/08	Fri 9/26/08	59
64		0%	Project Complete	0 days	Fri 9/26/08	Fri 9/26/08	63

21 Source Code

21.1 Copyright

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21.2 Programming Environment

The Windows desktop application was developed using Microsoft Visual Studio 2008 using the Microsoft .NET Framework 2.0 class library and written in the Visual Basic programming language.

The free KeyCodeGen (2007 John Mazza) library, under the GNU Lesser General Public License (http://www.gnu.org/licenses/lgpl.html), is embedded within the program to generate the License Key.

Elections Database Archives Comparison

Version: 1.0 Copyright 2008 Pima County
Report Run Date: 08/05/2008 14:46:29
Licensed Name: Edward Wittke

This application is copyright of Pima County - (C) Pima County 2008. All rights reserved. Any redistribution or reproduction of part or all of the contents in any form is prohibited.

Reference key of DATABASE FILES used

db0 = 01 20060504 142542 --- pima consolidated 051606 l and i oro valley .mdb <---------- L & A Database
db1 = 02 20060509 153136 --- pima consolidated 051606 OFFICIAL L AND A .mdb
db2 = 03 20060511 095632 --- pima consolidated 051606 EARLY DAY1 .mdb
db3 = 04 20060511 152334 --- pima consolidated 051606 EARLY DAY2 .mdb
db4 = 05 20060512 095822 --- pima consolidated 051606 EARLY DAY3 .mdb
db5 = 06 20060516 162654 --- pima consolidated 051606 EARLY DAY4 .mdb
db6 = 07 20060519 170142 --- pima consolidated 051606 EARLY DAY5 .mdb
db7 = 08 20060520 205038 --- pima consolidated 051606 .mdb
db8 = 09 20060520 205056 --- pima consolidated 051606 Final Totals .mdb
db9 = 10 20060520 205124 --- pima consolidated 051606 PROV DAY6 .mdb
db10 = 11 20060522 134322 --- pima consolidated 051606 post L and A .mdb
db11 = 12 20060530 141444 --- pima consolidated 051606 recount inhouse l and a .mdb
db12 = 13 20060531 142900 --- pima consolidated 051606 recount TOTALS .mdb
db13 = 14 20060531 142906 --- pima consolidated 051606 recount .mdb

KEY DATA ELEMENTS to be compared

K0 = Ballot
K1 = BallotRot
K2 = BallotRotCardRotPlateRot
K3 = BallotRotRaceRot
K4 = BaseunitBallotRot
K5 = Candidate
K6 = CandVGroup
K7 = Card
K8 = CardRot
K9 = District
K10 = Plate
K11 = PlateHeader
K12 = PlateRace
K13 = PlateRot
K14 = Race
K15 = VGroup
K16 = Preference/KeyID/20/card layout
K17 = Preference/KeyID/21/card suto layout
K18 = Preference/KeyID/25/margins
K19 = Preference/KeyID/50/AccuVote parameters
K20 = Preference/KeyID/55/ABasic report name
K21 = Preference/KeyID/60/card precinct ID
K22 = Preference/KeyID/140/card precinct ID

Comparison Results

	K0	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22	Result
db0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
db1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different

db7	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different
db8	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different
db9	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different
db10	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different
db11	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different
db12	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different
db13	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different

Detail Information of NOT Matched values

No.	Database Name		Table Name	Field Name	Num of Row
1	07 20060519 170142 --- pima consolidated 051606 EARLY DAY5 .mdb - db6		Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db6 = 'REGIONAL TRANSPORTATION PLAN'			
2	07 20060519 170142 --- pima consolidated 051606 EARLY DAY5 .mdb - db6		Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db6 = 'REGION TRANSPORTATION TAX'			
3	08 20060520 205038 --- pima consolidated 051606 .mdb - db7		Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db7 = 'REGIONAL TRANSPORTATION PLAN'			
4	08 20060520 205038 --- pima consolidated 051606 .mdb - db7		Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db7 = 'REGION TRANSPORTATION TAX'			
5	09 20060520 205056 --- pima consolidated 051606 Final Totals .mdb - db8		Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db8 = 'REGIONAL TRANSPORTATION PLAN'			
6	09 20060520 205056 --- pima consolidated 051606 Final Totals .mdb - db8		Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db8 = 'REGION TRANSPORTATION TAX'			
7	10 20060520 205124 --- pima consolidated 051606 PROV DAY6 .mdb - db9		Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db9 = 'REGIONAL TRANSPORTATION PLAN'			
8	10 20060520 205124 --- pima consolidated 051606 PROV DAY6 .mdb - db9		Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db9 = 'REGION TRANSPORTATION TAX'			
9	11 20060522 134322 --- pima consolidated 051606 post L and A .mdb - db10		Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db10 = 'REGIONAL TRANSPORTATION PLAN'			
10	11 20060522 134322 --- pima consolidated 051606 post L and A .mdb - db10		Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db10 = 'REGION TRANSPORTATION TAX'			
11	12 20060530 141444 --- pima consolidated 051606 recount inhouse l and a .mdb - db11		Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db11 = 'REGIONAL TRANSPORTATION PLAN'			
12	12 20060530 141444 --- pima consolidated 051606 recount inhouse l and a .mdb - db11		Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db11 = 'REGION TRANSPORTATION TAX'			
13	13 20060531 142900 --- pima consolidated 051606 recount TOTALS .mdb - db12		Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db12 = 'REGIONAL TRANSPORTATION PLAN'			
14	13 20060531 142900 --- pima consolidated 051606 recount TOTALS .mdb - db12		Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db12 = 'REGION TRANSPORTATION TAX'			
15	14 20060531 142906 --- pima consolidated 051606 recount .mdb - db13		Race - K14	Label	3

	Value	db0 = db13 =	'BOND QUESTION 1' 'REGIONAL TRANSPORTATION PLAN'		
16	14 20060531 142906 --- pima consolidated 051606 recount .mdb - db13		Race - K14	Label	4
	Value	db0 = db13 =	'BOND QUESTION 2' 'REGION TRANSPORTATION TAX'		

Attachment 3

Election Database Archives Comparison

Elections Database Archives Comparison

Version: 1.0 Copyright 2008 Pima County
Report Run Date: 08/05/2008 14:46:29
Licensed Name: Edward Wittke

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Reference key of DATABASE FILES used

db0 = 01 20060504 142542 --- pima consolidated 051606 l and i oro valley .mdb <--------- L & A Database
db1 = 02 20060509 153136 --- pima consolidated 051606 OFFICIAL L AND A .mdb
db2 = 03 20060511 095632 --- pima consolidated 051606 EARLY DAY1 .mdb
db3 = 04 20060511 152334 --- pima consolidated 051606 EARLY DAY2 .mdb
db4 = 05 20060512 095822 --- pima consolidated 051606 EARLY DAY3 .mdb
db5 = 06 20060516 162654 --- pima consolidated 051606 EARLY DAY4 .mdb
db6 = 07 20060519 170142 --- pima consolidated 051606 EARLY DAY5 .mdb
db7 = 08 20060520 205038 --- pima consolidated 051606 .mdb
db8 = 09 20060520 205056 --- pima consolidated 051606 Final Totals .mdb
db9 = 10 20060520 205124 --- pima consolidated 051606 PROV DAY6 .mdb
db10 = 11 20060522 134322 --- pima consolidated 051606 post L and A .mdb
db11 = 12 20060530 141444 --- pima consolidated 051606 recount inhouse l and a .mdb
db12 = 13 20060531 142900 --- pima consolidated 051606 recount TOTALS .mdb
db13 = 14 20060531 142906 --- pima consolidated 051606 recount .mdb

KEY DATA ELEMENTS to be compared

K0 = Ballot
K1 = BallotRot
K2 = BallotRotCardRotPlateRot
K3 = BallotRotRaceRot
K4 = BaseunitBallotRot
K5 = Candidate
K6 = CandVGroup
K7 = Card
K8 = CardRot
K9 = District
K10 = Plate
K11 = PlateHeader
K12 = PlateRace
K13 = PlateRot
K14 = Race
K15 = VGroup
K16 = Preference/KeyID/20/card layout
K17 = Preference/KeyID/21/card suto layout
K18 = Preference/KeyID/25/margins
K19 = Preference/KeyID/50/AccuVote parameters
K20 = Preference/KeyID/55/ABasic report name
K21 = Preference/KeyID/60/card precinct ID
K22 = Preference/KeyID/140/card precinct ID

Comparison Results

	K0	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	K13	K14	K15	K16	K17	K18	K19	K20	K21	K22	Result
db0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
db1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Match
db6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different

db7	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different
db8	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different
db9	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different
db10	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different
db11	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different
db12	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different
db13	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y	Y	Y	Y	Different

Detail Information of NOT Matched values

No.	Database Name		Table Name	Field Name	Num of Row
1	07 20060519 170142 --- pima consolidated 051606 EARLY DAY5 .mdb - db6		Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db6 = 'REGIONAL TRANSPORTATION PLAN'			
2	07 20060519 170142 --- pima consolidated 051606 EARLY DAY5 .mdb - db6		Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db6 = 'REGION TRANSPORTATION TAX'			
3	08 20060520 205038 --- pima consolidated 051606 .mdb - db7		Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db7 = 'REGIONAL TRANSPORTATION PLAN'			
4	08 20060520 205038 --- pima consolidated 051606 .mdb - db7		Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db7 = 'REGION TRANSPORTATION TAX'			
5	09 20060520 205056 --- pima consolidated 051606 Final Totals .mdb - db8		Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db8 = 'REGIONAL TRANSPORTATION PLAN'			
6	09 20060520 205056 --- pima consolidated 051606 Final Totals .mdb - db8		Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db8 = 'REGION TRANSPORTATION TAX'			
7	10 20060520 205124 --- pima consolidated 051606 PROV DAY6 .mdb - db9		Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db9 = 'REGIONAL TRANSPORTATION PLAN'			
8	10 20060520 205124 --- pima consolidated 051606 PROV DAY6 .mdb - db9		Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db9 = 'REGION TRANSPORTATION TAX'			
9	11 20060522 134322 --- pima consolidated 051606 post L and A .mdb - db10		Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db10 = 'REGIONAL TRANSPORTATION PLAN'			
10	11 20060522 134322 --- pima consolidated 051606 post L and A .mdb - db10		Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db10 = 'REGION TRANSPORTATION TAX'			
11	12 20060530 141444 --- pima consolidated 051606 recount inhouse l and a .mdb - db11		Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db11 = 'REGIONAL TRANSPORTATION PLAN'			
12	12 20060530 141444 --- pima consolidated 051606 recount inhouse l and a .mdb - db11		Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db11 = 'REGION TRANSPORTATION TAX'			
13	13 20060531 142900 --- pima consolidated 051606 recount TOTALS .mdb - db12		Race - K14	Label	3
	Value	db0 = 'BOND QUESTION 1' db12 = 'REGIONAL TRANSPORTATION PLAN'			
14	13 20060531 142900 --- pima consolidated 051606 recount TOTALS .mdb - db12		Race - K14	Label	4
	Value	db0 = 'BOND QUESTION 2' db12 = 'REGION TRANSPORTATION TAX'			
15	14 20060531 142906 --- pima consolidated 051606 recount .mdb - db13		Race - K14	Label	3

	Value	db0 = db13 =	'BOND QUESTION 1' 'REGIONAL TRANSPORTATION PLAN'		
16	14 20060531 142906 --- pima consolidated 051606 recount .mdb - db13		*Race - K14*	*Label*	4
	Value	db0 = db13 =	'BOND QUESTION 2' 'REGION TRANSPORTATION TAX'		