

CSCI 371 Project 4 Final Report

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I. Development Tools

Frontend

- PHP
- HTML
- CSS

Backend

- MAMP
 - MySQL (for database management system)
 - Apache (for server)

Development

- Vim (for text editor)
- GitHub (for version control)

II. Deployment Instructions

The following instructions detail how to deploy the frontend app. An installation of MAMP, a copy of the database (found in db.sql), and a copy of the app source files (found in frontend.zip) are required.

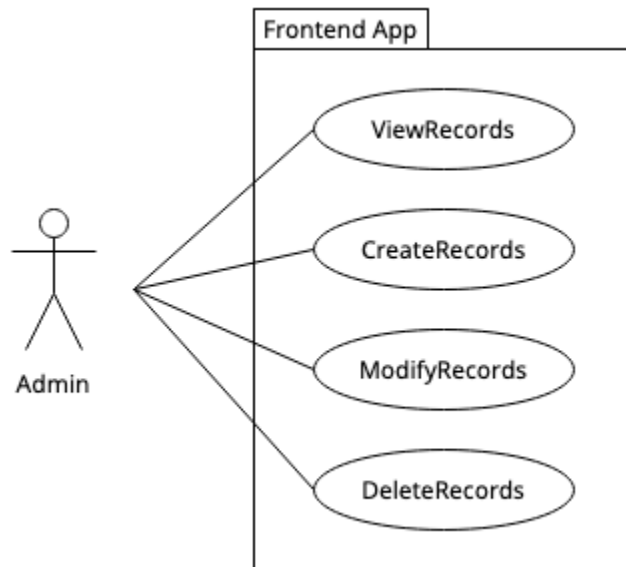
1. Install MAMP (instructions can be found at <https://www.mamp.info/en/mamp/>).
2. Load the database (found in db.sql) into MySQL.
3. Extract the app source files from frontend.zip and place them into the MAMP/htdocs folder.
4. Start the MAMP server.
5. The app home page can now be accessed at <http://localhost/index.php> or <http://localhost:8888/index.php>, depending on the version of MAMP installed.

III. User Groups

This app supports a single user group, referred to as the “Admin” user group, which consists of all users with full administrative privileges for all tables in the database.

IV. User Requirements

Use Case Diagram



User and System Requirements

A. View Records

1. The user will be able to choose a table from which to view records.
2. The user will be able to filter the data from that table.
 - 2.1. The system will allow the user to apply a filter to each column using a comparand and a variety of comparison operations.
 - 2.2. The system will allow the user to apply any or all filters.
 - 2.3. The system will allow the user to view unfiltered data by not applying filters.
3. The user will be able to view the resulting records.
 - 3.1. The system will display the number of resulting records.
 - 3.2. The system will present the records in tabular format.
 - 3.3. For each foreign key field, the field will be presented as a hyperlink which, when clicked, will take the user to a page displaying the details for the record that is referenced by the foreign key field.
 - 3.4. Derived attributes will be calculated and displayed to the user as a regular column.

- 3.5. The component columns of each composite attribute will be combined into a single composite column for display.

B. Create Records

1. The user will be able to choose a table into which to insert the new record.
2. The user will be able to specify the data for the new record.
 - 2.1. The system will clearly mark which fields are required or optional. The system will prevent the user from submitting the form until all required fields have been filled.
 - 2.2. For each foreign key field, the system will allow the user to choose from the preexisting values of the primary key which that field references.
3. The user will be able to insert this data as a new record.
 - 3.1. The system will enforce database integrity constraints.
 - 3.2. The system will inform the user if the insert operation cannot be completed because of constraint violations (such as duplicate primary keys).

C. Modify Records

1. The user will be able to choose a record to modify.
2. The user will be able to enter the new values for the record.
 - 2.1. The system will clearly mark which fields are required or optional. The system will prevent the user from submitting the form until all required fields have been filled.
 - 2.2. For each foreign key field, the system will allow the user to choose from the preexisting values of the primary key which that field references.
3. The user will be able to apply these changes to the record.
 - 3.1. The system will enforce database integrity constraints.
 - 3.2. The system will update any other records that reference this record using the cascade on update option, and it will notify the user that it has done so.
 - 3.3. The system will inform the user if the update operation cannot be completed because of constraint violations (such as duplicate primary keys).

D. Delete Records

1. The user will be able to choose a record to delete.
2. The user will be able to delete this record.

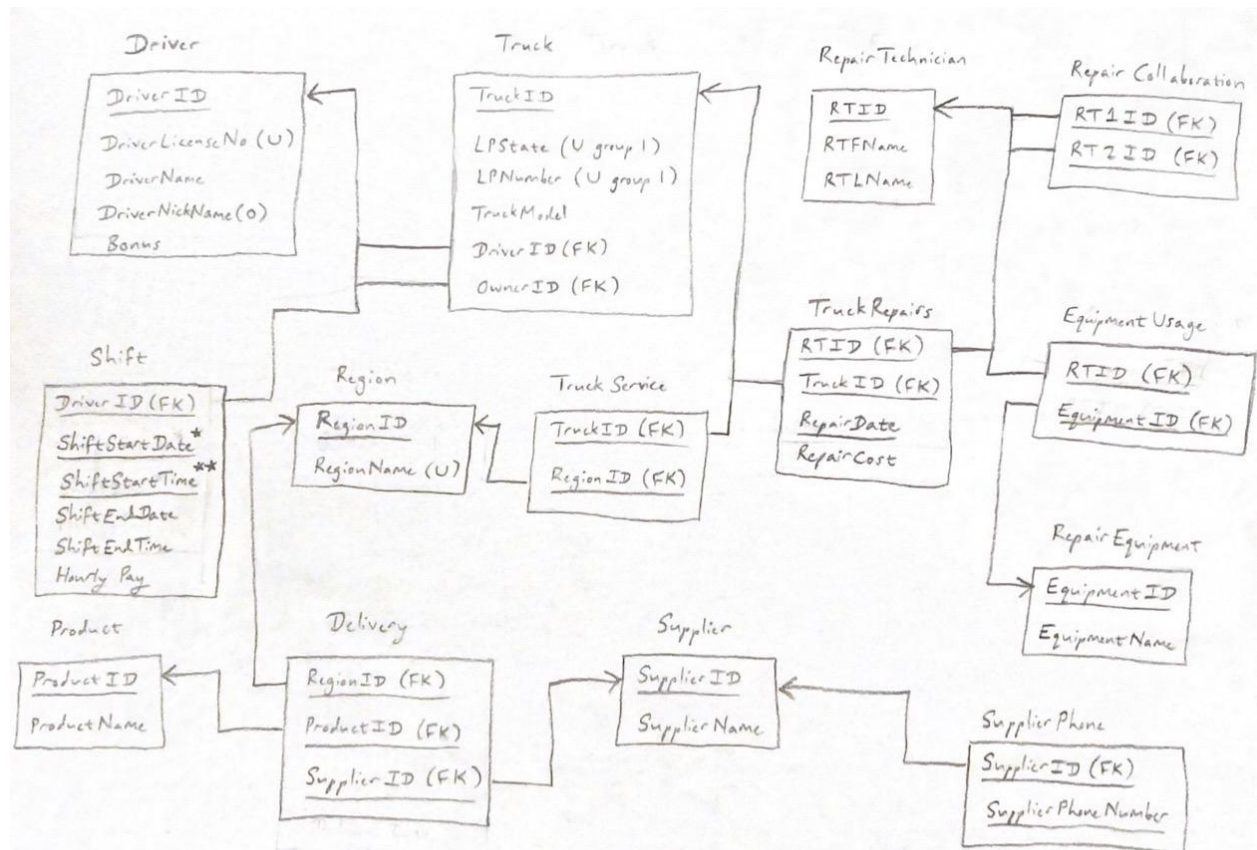
- 2.1. The system will confirm that the user wants to delete the record before deleting it. It will notify the user that deleting the record will also delete any other records that reference this record.
- 2.2. If the user cancels the deletion operation, the system will return the user to the previous page without deleting any records.
- 2.3. If the user confirms the deletion operation, the system will delete the selected record as well as any other records that reference this record using the cascade on delete option. It will then notify the user that it has done so.

Domain / Non-Functional Requirements

1. The system should sanitize user input to protect against SQL injection and XSS attacks.
2. The system should provide basic client-side validation of user input to assist the user with data entry and reduce SQL errors.
3. If a CRUD operation on the database cannot be successfully completed, the frontend should display a relevant error message instead of crashing.
4. Error messages displayed by the frontend to the user should not expose sensitive or exploitable information.

V. Database Specifications

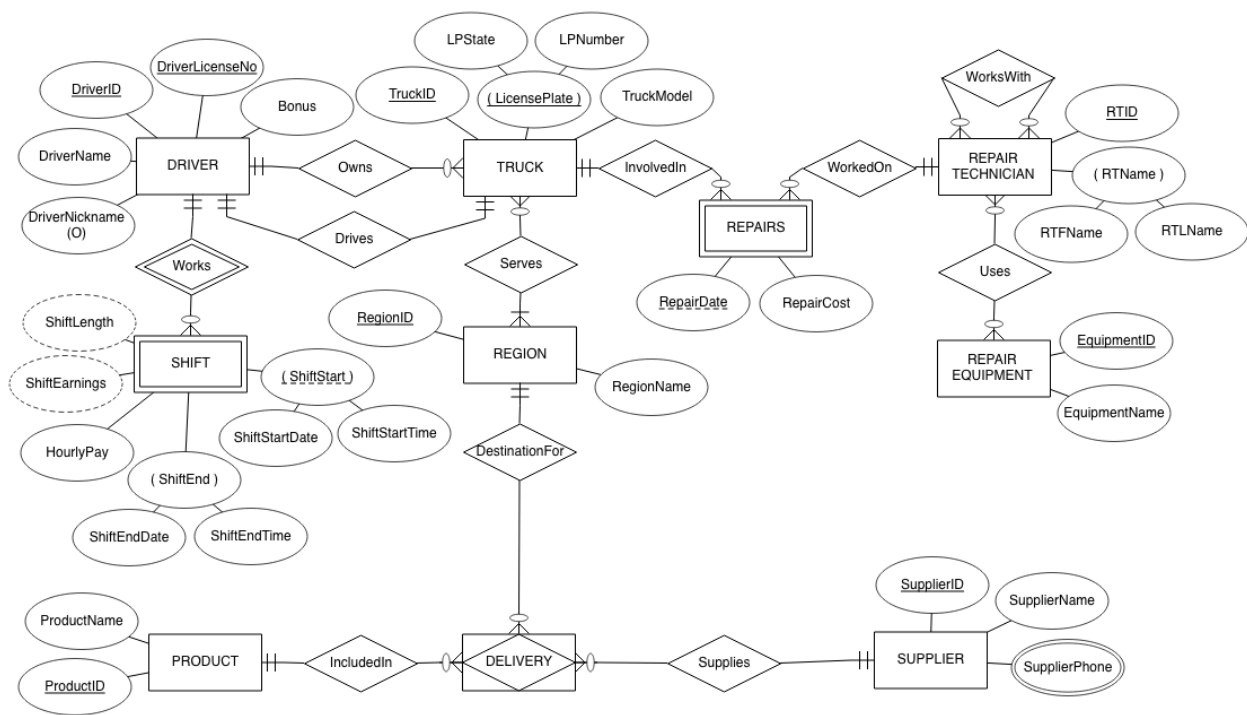
Relational Schema



* ShiftStartDate must be less than or equal to ShiftEndDate.

** If ShiftStartDate is equal to ShiftEndDate, then ShiftStartTime must be less than ShiftEndTime.

ER Diagram



Requirements

- The database will keep track of drivers, trucks, shifts, repairs, repair technicians, repair equipment, regions, products, and suppliers.
- For each driver, the database will keep track of their unique driver ID, their unique driver license number, their name, an optional nickname, and their bonus.
- For each truck, the database will keep track of its unique truck ID, its unique license plate (which consists of a state and a license plate number), and its model.
- For each shift, the database will keep track of its start (which consists of a start date and start time), its end (which consists of an end date and end time), the hourly pay, the length of the shift (which can be calculated using the start and end), and the total earnings (which can be calculated using the start, end, and hourly pay).
- For each instance of repairs, the database will keep track of the date and the cost.
- For each repair technician, the database will keep track of their unique repair technician ID and their name (which consists of a first name and a last name).
- For each piece of repair equipment, the database will keep track of its unique equipment ID and its name.
- For each region, the database will keep track of its unique region ID and its unique region name.
- For each product, the database will keep track of its unique product ID and its name.
- For each supplier, the database will keep track of its unique supplier ID, its name, and one or more phone numbers.

- Each driver can own multiple trucks but does not have to own any. Each truck is owned by one driver.
- Each driver drives one truck. Each truck is driven by one driver.
- Each driver works zero or more shifts. Each shift is worked by one driver. Two or more shifts can have the same start time, but the shifts worked by a single driver have different start times because each driver can work only one shift at a time.
- Each repair technician works on repairs for zero or more trucks. Each truck is repaired by zero or more repair technicians. Two or more instances of repairs can involve the same repair technician and truck, in which case they must have different dates.
- Each repair technician works with zero or more other repair technicians. Each repair technician is worked with by zero or more other repair technicians.
- Each repair technician uses zero or more pieces of repair equipment. Each piece of repair equipment is used by zero or more repair technicians.
- Each truck serves one or more regions. Each region is served by zero or more trucks.
- The database will keep track of which product is delivered to which region by which supplier.
- Each region is the destination for zero or more deliveries of one or more products from one or more suppliers.
- Each product is delivered to zero or more regions by one or more suppliers.
- Each supplier provides zero or more products for delivery to one or more regions.

VI. Implementation Details

The app implementation involves the execution of up to 11 distinct SQL statements for CRUD operations on a given table in the database. Specifically, 1 SQL statement is executed to view records for a given table, up to 4 SQL statements are executed to create a new record, up to 5 SQL statements are executed to modify a record, and 1 SQL statement is executed to delete a record.

The app provides four basic services for the Admin user group, as specified by the Use Case Diagram: viewing, creating, modifying, and deleting records. These services are described below.

1. View Records

This service allows the user to view records for any table. This service is divided into two subcases: 1) viewing records without filtration, and 2) viewing records with filtration.

1.a. Viewing Records Without Filtration

To view records without filtration, the user can click the “View Table Records” button on the home page.

ABC Dispatcher Company Dashboard
NEITHER RAIN NOR SNOW NOR GLOOM OF NIGHT CAN STAY THESE MESSENGERS ABOUT THEIR DUTY.
Choose an action:

The user will then be taken to a page with a dropdown menu that will allow them to choose the table for which to view records.

Choose a table for which to view records:

Shifts

Once the user has chosen a table, all of the records in that table will be displayed in tabular format with helpful column labels. The data presented includes derived attributes which are not actually stored in the database but are presented to the user by the frontend. For example, in the screenshot below, the columns “Shift Length (Hours)” and “Shift Earnings” are derived attributes. The user is also given the option to modify or delete each record (see the Modify Record and Delete Record services, respectively, for more details).

5 matching records were found.

Shifts

Driver ID	Shift Start Date	Shift Start Time	Shift End Date	Shift End Time	Shift Length (Hours)	Shift Earnings	Hourly Pay	Actions
1	2022-09-28	06:00:00	2022-09-28	14:00:00	8.00	232.00	29.00	Modify Record / Delete Record
1	2022-09-30	09:00:00	2022-09-30	17:00:00	8.00	232.00	29.00	Modify Record / Delete Record
2	2022-09-28	06:00:00	2022-09-28	14:00:00	8.00	224.00	28.00	Modify Record / Delete Record
2	2022-09-28	17:30:00	2022-09-29	03:00:00	9.50	294.50	31.00	Modify Record / Delete Record
3	2022-09-28	10:00:00	2022-09-28	18:00:00	8.00	216.00	27.00	Modify Record / Delete Record

Any foreign key values will be displayed as hyperlinks which, when clicked, will take the user to a page displaying the data for the referenced record. For example, in the screenshot above, clicking the value in the first row of the “Driver ID” column will take the user to the page in the screenshot below.

1 matching record was found.

Drivers

ID	License #	Name	Nickname	Bonus	Actions
1	62202687	Victoria Terpsichore	V.T.	4200.00	Modify Record / Delete Record

Return to Home

Finally, the component columns of composite attributes are combined into a single composite column for display to the user, as can be seen in the screenshot below (the column “Name” is a composite column made up of the components “First Name” and “Last Name”).

4 matching records were found.

Repair Technicians

ID	Name	Actions
1	Aule Mahal	Modify Record / Delete Record
2	Celebrimbor O'Eregion	Modify Record / Delete Record
3	Telchar O'Nogrod	Modify Record / Delete Record
4	Feanor Finwion	Modify Record / Delete Record

[Return to Home](#)

1.b. Viewing Records With Filtration

Alternatively, the user can click the “Filter Table Records” button on the home page to filter the records before viewing them. As with subcase 1.a, the user is taken to a page with a dropdown menu where they can choose the table whose records they want to filter.

Choose a table for which to filter records:

Once the table has been chosen, the user will be taken to a page with a form where they can filter the results by the various columns of the table (including derived attributes). By toggling between the “Match All” and “Match Any” options, the user can choose whether the results must match all of the specified filters or merely match at least one filter.

Filter records for Shifts:

Field	Operator	Comparand
Driver ID	is	
Shift Start Date	is	mm / dd / yyyy
Shift Start Time	is	-- : -- --
Shift End Date	is	mm / dd / yyyy
Shift End Time	is	-- : -- --
Shift Length (Hours)	is	
Shift Earnings	is	
Hourly Pay	is	

☒ Match All ☐ Match Any

Apply Filter

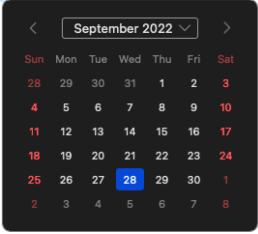
For each column, the user can input a comparand that will be used to filter the data for that column. (If the user does not enter a comparand for a column, the data will not be filtered by that column.) The app uses different types of input elements corresponding to the types of the respective columns to facilitate easier and more accurate data entry. For example, in the screenshot below, the “Shift Start Date” and “Shift End Date” comparand input fields are presented by supporting browsers as a date picker interface.

Filter records for Shifts:

Field	Operator	Comparand
Driver ID	is	
Shift Start Date	is	mm / dd / yyyy
Shift Start Time	is	-- : -- --
Shift End Date	is	09 / 28 / 2022
Shift End Time	is	
Shift Length (Hours)	is	
Shift Earnings	is	
Hourly Pay	is	

☒ Match All
 ☐ Match Any

Apply Filter



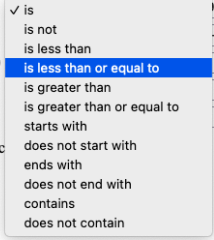
Additionally, the user can use the dropdown menus to select a comparison operator for each column, which determines how the values for that column will be compared against the comparand. Available options include filtering results by exact matches, fuzzy matches, or matches less than or greater than the comparand.

Filter records for Shifts:

Field	Operator	Comparand
Driver ID	is	
Shift Start Date	is	mm / dd / yyyy
Shift Start Time	is	-- : -- --
Shift End Date	is	09 / 28 / 2022
Shift End Time	is	-- : -- --
Shift Length (Hours)	is less than or equal to	
Shift Earnings	is	
Hourly Pay	is	

☒ Match All
 ☐ Match Any

Apply Filter



Once the user has applied their selected filters, they will be taken to a page displaying the results, as in subcase 1.a.

3 matching records were found.

Shifts

Driver ID	Shift Start Date	Shift Start Time	Shift End Date	Shift End Time	Shift Length (Hours)	Shift Earnings	Hourly Pay	Actions
1	2022-09-28	06:00:00	2022-09-28	14:00:00	8.00	232.00	29.00	Modify Record / Delete Record
2	2022-09-28	06:00:00	2022-09-28	14:00:00	8.00	224.00	28.00	Modify Record / Delete Record
3	2022-09-28	10:00:00	2022-09-28	18:00:00	8.00	216.00	27.00	Modify Record / Delete Record

[Return to Home](#)

2. Create Records

This service allows the user to create a new record and insert it into an existing table. The user accesses this service by clicking the “Insert New Record” button on the home page.

ABC Dispatcher Company Dashboard
NEITHER RAIN NOR SNOW NOR GLOOM OF NIGHT CAN STAY THESE MESSENGERS ABOUT THEIR DUTY.
Choose an action:

View Table Records

Filter Table Records

Insert New Record

The user will then be taken to a page with a dropdown menu that will allow them to choose the table into which to insert the new record.

Choose a table into which to insert a record:

Trucks

Choose

Once the user has chosen a table, they will be taken to a page with a form for inputting the values for the new record. For each column that is a foreign key, the user can use a dropdown menu to choose from the preexisting values of the primary key which that field references.

***: required**

Field	Value
ID	<input type="text"/> *
License Plate State	<input type="text"/> *
License Plate Number	<input type="text"/> *
Model	<input type="text"/> *
Driver ID	<input type="text" value="1"/> *
Owner ID	<input type="text" value="1"/> *

For non-foreign-key columns, the app uses different types of input elements corresponding to the types of the respective columns to facilitate easier and more accurate data entry. If the user tries to enter data that does not match the type of the field, the app will warn them about this when they try to submit the form and prevent them from doing so until the error is corrected, as in the screenshot below.

***: required**

Field	Value
ID	forty-two *
License Plate State	<div>Please enter a number.</div> *
License Plate Number	*
Model	Heart of Gold *
Driver ID	1 *
Owner ID	1 *

All required fields are marked with a red asterisk. If the user leaves any required field blank, the app will warn them about this when they try to submit the form and prevent them from doing so until the error is corrected, as in the screenshot below.

***: required**

Field	Value
ID	42 *
License Plate State	IL *
License Plate Number	D0UGL4S4D4M5 *
Model	*
Driver ID	<div>Please fill out this field.</div> *
Owner ID	*

Once the user has finished filling out the form and submitted it, the app will attempt to execute the insertion request using the provided values. It will then inform the user about the success of

the operation. If the request could not be completed (for example, because a record with the same primary key already exists), the user will be informed of this.

The operation has succeeded. 1 record has been inserted.

[View Modified Table](#)

[Return to Home](#)

Finally, the user has the option to view the modified table and confirm that the record has in fact been inserted.

4 matching records were found.

Trucks

ID	License Plate	Model	Driver ID	Owner ID	Actions
1	CA 6ACS473	BUCEPHALUS MK1	1	1	Modify Record / Delete Record
2	WA B37751E	EPONA MK1	2	3	Modify Record / Delete Record
3	CT AH52378	EPONA MK2	3	3	Modify Record / Delete Record
42	IL 4D4M5	Heart of Gold	1	1	Modify Record / Delete Record

[Return to Home](#)

3. Modify Records

This service allows the user to modify a preexisting record. The user accesses this service by first viewing the desired record (see the “View Records” service for details about how to do this) and then clicking the “Modify Record” link next to the record.

4 matching records were found.

Trucks					
ID	License Plate	Model	Driver ID	Owner ID	Actions
1	CA 6ACS473	BUCEPHALUS MK1	1	1	Modify Record / Delete Record
2	WA B37751E	EPONA MK1	2	3	Modify Record / Delete Record
3	CT AH52378	EPONA MK2	3	3	Modify Record / Delete Record
42	IL 4D4M5	Heart of Gold	1	1	Modify Record / Delete Record

Return to Home

Clicking the “Modify Record” link will take the user to a page with a form where they can modify the record. The details for how the user inputs the new values are almost exactly the same as with the “Create Records” service. The only difference is that, in this case, the current values of the record are listed as placeholders.

*: required

Field	Value
ID	42 *
License Plate State	IL *
License Plate Number	4D4M5 *
Model	Heart of Gold *
Driver ID	1 ▾ *
Owner ID	1 ▾ *

Apply Changes

Once the user has made all desired changes and submitted the form, the app will attempt to execute the update request using the provided values. It will then inform the user about the success of the operation. If the request succeeds, any other records that reference this record will also be automatically updated as necessary using the cascade on update option, and the user will be notified of this as well. If the request could not be completed (for example, because the new value for a field is too long), the user will be notified about the error.

The operation has succeeded. 1 record has been modified. Any other records that reference this record have been updated as necessary.

View Modified Table

Return to Home

Finally, the user has the option to view the modified table and confirm that the record has in fact been modified.

4 matching records were found.

Trucks

ID	License Plate	Model	Driver ID	Owner ID	Actions
1	CA 6ACS473	BUCEPHALUS MK1	1	1	Modify Record / Delete Record
2	WA B37751E	EPONA MK1	2	3	Modify Record / Delete Record
3	CT AH52378	EPONA MK2	3	3	Modify Record / Delete Record
42	IL 4D4M5	HEART OF GOLD	1	1	Modify Record / Delete Record

[Return to Home](#)

4. Delete Records

This service allows the user to delete a preexisting record. The user accesses this service by first viewing the desired record (see the “View Records” service for details about how to do this) and then clicking the “Delete Record” link next to the record.

4 matching records were found.

Trucks					
ID	License Plate	Model	Driver ID	Owner ID	Actions
1	CA 6ACS473	BUCEPHALUS MK1	1	1	Modify Record / Delete Record
2	WA B37751E	EPONA MK1	2	3	Modify Record / Delete Record
3	CT AH52378	EPONA MK2	3	3	Modify Record / Delete Record
42	IL 4D4M5	HEART OF GOLD	1	1	Modify Record / Delete Record

[Return to Home](#)

The user will be prompted to confirm the deletion request and warned that this will also result in the deletion of any other records that reference this record.

Are you sure you want to delete this record? Any other records that reference this record will also be deleted.

[Cancel Deletion and Return to Previous Page](#)

[Confirm Deletion](#)

If the user clicks the “Cancel Deletion and Return to Previous Page” link, they will be taken back to the previous page. If they click the “Confirm Deletion” link, the app will attempt to execute the deletion request. It will then inform the user about the success of the operation. Any other records that reference this record will also be automatically deleted as necessary using the cascade on delete option, and the user will be notified of this as well.

The operation has succeeded. 1 record has been deleted. Any other records that reference this record have been deleted as necessary.

[View Modified Table](#)

[Return to Home](#)

Finally, the user has the option to view the modified table and confirm that the record has in fact been deleted.

3 matching records were found.

Trucks

ID	License Plate	Model	Driver ID	Owner ID	Actions
1	CA 6ACS473	BUCEPHALUS MK1	1	1	Modify Record / Delete Record
2	WA B37751E	EPONA MK1	2	3	Modify Record / Delete Record
3	CT AH52378	EPONA MK2	3	3	Modify Record / Delete Record

[Return to Home](#)