Oregon Department of Transportation

Road Usage Charge Implementation

Road Usage Charge Implementation

Interface Control Document

Version 3.1

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Purpose

• To describe the specifications for interfaces between subsystems of the RUC system.

Revision History

Date Of Revision	Reason For the Change and Short Summary of the Revisions Made	Version Number
1/25/12	Conceptual	1.0
6/25/12	Oregon RUC Pilot	2.0
6/27/13	Oregon RUC Volunteer Program	3.0

1. Introduction

The introduction section presents a brief overview of the system and interface to which this Interface Control Document (ICD) applies to help the reader understand how the document is organized and how to read and interpret it.

System Name: Oregon Road Usage Charging (RUC) System
System Acronym: RUC System
System Owner Information: ODOT OIPP

Interface Described: This ICD covers the interface between Mileage Collection subsystem and Road Usage Charge Processing subsystem, the mileage message; and the interface between the Road Usage Charge Processing subsystem and Road Usage Charging Accounting subsystem

A diagram of the architecture is included in section 3.1 below.

1.1 Document Overview

This document describes the mileage message, and the message response given in acknowledgement of that message. This version of the report is updated for lessons learned in the Road Usage Charging Pilot Project (RUCPP).

This document provides the specifications for the interfaces between the subsystems of the RUC system. The interface specifications may change before full system implementation, as new development occurs.

1.2 References

- Oregon Vehicle Road Usage Charge System Strategic Program Plan (Final) November 07, 2011, DOC Control No. 29142-111107-01
- Oregon Road Usage Charge System Pre-Legislative Concept of Operations – Final Draft May 17, 2013
- Oregon Road Usage Charge System Requirements Documents v3.0

1.3 Definitions, Acronyms, and Abbreviations

CSP – Certified Service Provider, an entity certified by the State of Oregon to record the miles traveled by RUC eligible vehicles, collect the RUC due on behalf of the State, and provide RUC account management.

Mileage Rule ID—an identifier associated with a geographic area, or zone, in which a specific rate per mile will be assessed for miles traveled (the rate may be zero, for out of state travel for instance).

RUCA – Road Usage Charge Accounting

RCP – Road Usage Charge Processing

VIN – Vehicle Identification Number

2. Project History

This section describes project information as it relates to requirements.

2.1 Project Context

Project Name: Oregon Vehicle Road Usage Charging (RUC) System
Project Start Date: May 2011
System Version or Release #: TBD

The Oregon Road Usage Charging System will implement a Road Usage Charge to provide road user charging for high mileage vehicles and/or a volunteer group of vehicles. This system will allow for automatic collection of road use charges from subject vehicles. In the automatic options, a Road Usage Charge Processing subsystem, which is comprised of a Mileage Reporting Device (MRD) and a Data Collection component (which may be located in the MRD, or may be located in a fixed server) that will send a "mileage message" to Road Usage Charge Processing servers run by Certified Service Providers (CSPs). This mileage message is defined in this document. This system includes a Road Usage Charge Processing subsystem to administer customer accounts, collect information from vehicles, invoice customers, and send accrued revenue to the State Treasury ODOT. It also includes a Road Usage Charge Accounting (RUCA) subsystem, internal to ODOT. RUCA functions include audits and account reconciliations of CSP reports required for financial operation and monitoring of the entire system. In addition to the mileage message, this interface control document defines the interface between these two subsystems.

2.2 Project Technical Documents

The technical aspects of the project work are documented primarily in the following documents (business, administrative, and programmatic aspects of the work are documented elsewhere):

- The Concept of Operations (Concept of Operations), a Systems Engineering document that describes how the system operates at a high level, from the user's perspective.
- A System Requirements Specification (SRS) that provides the functional technical requirements for the component subsystems.
- An Interface Control Document (ICD) which provides technical specifications of all system interfaces.
- A Road Usage Charge Accounting Base Procedures documents, which describes the way the Road Usage Charge Accounting system works from a business operations perspective

2.3 Open Systems Objective

ODOT desires this system to be fully open, which in this case means that the technology provider (the provider of the Mileage Collection subsystem) is independent of the CSP. ODOT will certify any technology-providing firm complying with the specifications to be a technology provider, and ODOT will certify any service-providing firm complying with the specifications to be a CSP. Conformance to the interface specified in this document is mandatory for any technology provider and any CSP.

2.4 Applicable Standards and Preferences

- REST
- JSON

- HTTP
- TCP
- IP

There is no standard/preference for over-the-air communication.

2.5 Interface Control Standardization

Having a standardized interface is vital to operating open systems. Having a standardized interface will allow MRDs from various technology vendors to operate with service providers.

This interface control document embraces a ‘cloud-based’ approach to communications from Mileage Collection. This cloud-based approach may employ any communications medium permitting an Internet connection. This form of specification will provide a robust, future-proof communications standard.

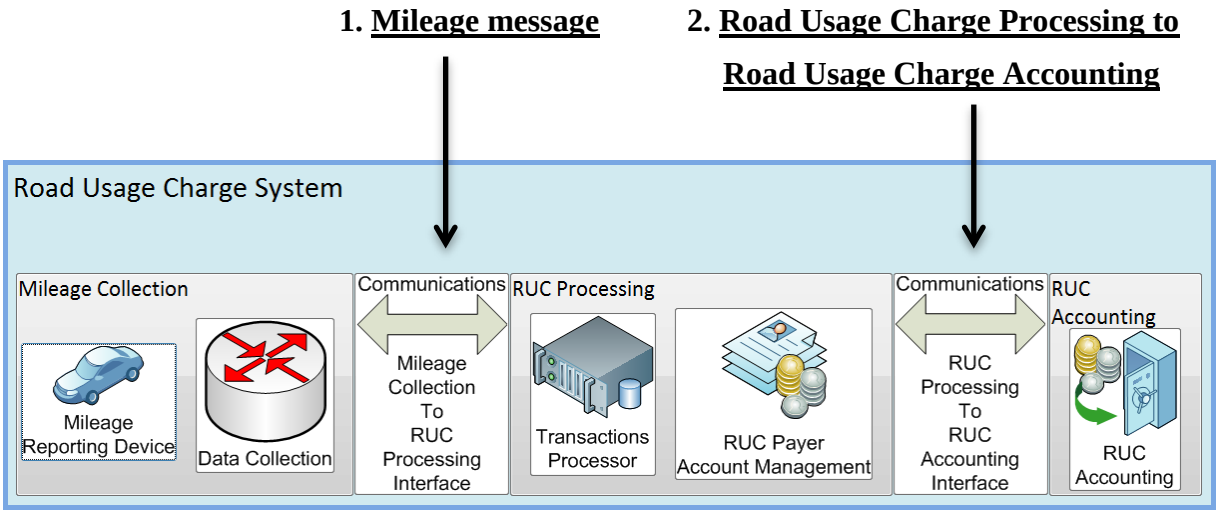
Within Internet communications, this interface control document employs JSON messages because they are an industry standard for human readable, yet relatively low overhead communications.

3. Scope and Identification of Systems

3.1 Scope

This Interface Control Document (ICD) specifies the interface between:

- The Mileage Collection Subsystem and the Road Usage Charge Processing Subsystem, and
- The Road Usage Charge Processing Subsystem and he Road Usage Charge Accounting Subsystem.



3.2 System Identification

3.2.1 Interface 1 – Mileage Message

3.2.1.1 Mileage Collection Subsystem (System 1)

Mileage Collection is comprised of the MRD and the Data Collection component, which may or may not be housed in the MRD. The MRD collects mileage driven for each travel zone if an advanced MRD plan is selected. Data Collection receives mileage transactions (and zone mileage) from the MRD and creates mileage messages. Data Collection also transmits summary mileage data to the Road Usage Charge Processing Subsystem (it sends/pushes the mileage message to System 2).

3.2.1.2 Road Usage Charge Processing Subsystem (System 2)

Road Usage Charge Processing receives daily mileage transaction records from Data Collection and processes the mileage data against an approved mileage rate-charging module. Both mileage and calculated revenue is posted to an existing account for a Road Usage Charge payer. System 2 is run by a CSP, either a third-party provider, or the ODOT-managed CSP. It acknowledges the message with a JSON response.

3.2.2 Interface 2 – RUCP to RUCA

3.2.2.1 Road Usage Charge Processing Subsystem (System 2)

Road Usage Charge Processing (RUCP) is comprised of the Transactions Processor component and the Road Charge Account Management component.

Road Usage Charge Processing collects monthly summary mileage and revenue data, prepares electronic reports, and transmits them to the RUCA. The RUCP develops three required reports: the Mileage and RUC Revenue Report, the VIN Summary Report, and the Errors and Events Report. The RUCP transmits road charges calculated for all RUC payers during the period and transmits funds to the appropriate state treasurer monthly. System 2 is run by a CSP, which may be ODOT, or a private provider.

3.2.2.2 Road Usage Charge Accounting (System 3)

The Road Usage Charging Accounting (RUCA) subsystem oversees financial operations of all Road User Charge Processing subsystems (CSPs and ODOT). RUCA audits, edits and verifies the completeness and correctness of the mileage and revenue data. RUCA confirms revenue transfers to the appropriate state treasurer and provides accounting posting information. RUCA develops operational and statistical reports for verification of monthly operations, revenue forecasting and to document the viability of the program.

4. Interface 1 – Mileage Message

4.1 Interface overview

Interface 1, Mileage Collection to RUCP is a mileage message that is a cloud-based interface. It is independent of communication channel, and specific hardware or software. Any Mileage Collection subsystem that can send the message to any service provider that can receive the message is appropriate.

Interface 2, RUCP to RUCA is an exchange of data tables. In full implementation, it will be an automated electronic process. However, for the pilot project, an exchange of spreadsheets was used.

4.1.1 Business Process

For interface 1, the vehicle owner must have the MRD installed (except for RUC payers on flat fee plans), and must register the MRD with a CSP, which includes setting up an account. The CSP must operate the system as defined in the requirements, including billing/invoicing, payment collection, and payment to ODOT. (See the Mileage Collection subsystem requirements and the Road Usage Charge Processing subsystem requirements in the System Requirements Specification for further details.)

For interface 2, the Road Usage Charge Processing subsystem will submit data tables to the RUC Accounting subsystem on a regular, periodic basis, as specified by the RUCA. The Road Usage Charge Processing subsystem will to assemble the data.

4.1.2 Data Transfer

For Interface 1, data will be sent from the Mileage Collection subsystem to the CSP in a cloud-based fashion. The data is as specified in the mileage message below. The frequency of transmission is specified in a parameter in the Mileage Collection subsystem.

For Interface 2, the Road Usage Charge Processing subsystem will send the data tables to the Road Usage Charge Accounting subsystem via e-mail. The frequency of transmission will be specified by the RUC Accounting subsystem and the Services Contract with ODOT. Periodically as needed, the RUCA will provide updates to the mileage rate tables.

4.1.3 Transactions

For Interface 1, transactions are comprised of one daily mileage message moving from Mileage Collection to Road Usage Charge Processing. Transactions will be acknowledged by the Road Usage Charge Processing system with a standard RESTful message acknowledgement if the message can be parsed and passes checksums. If the message fails data validation, a failure message will be sent to the Mileage Collection subsystem from which it came. The failure message is included below.

For Interface 2, transactions are comprised of one data table of each report being e-mailed from the Road Usage Charge Processing subsystem to the RUC Accounting subsystem.

4.1.4 Security and Integrity

Electronic Security is vital to a successful road usage charge system. There are two primary security measures that are needed to support a simple messaging interface such as this one:

Authentication and Encryption. ODOT has not yet chosen the precise Authentication and Encryption measures to use.

For Authentication, ODOT is considering four possible RESTful web services-based authentication options:

1. JavaScript Object Signing and Encryption (JOSE), a new standard of authentication that uses JSON messaging. "Among the important work going on at the IETF are protocols leveraging JSON, including JavaScript Object Signing and Encryption (JOSE), a secure object format that ensures confidentiality and integrity, much like S/MIME does for email. JOSE can incorporate a number of features, including JSON Web Signature (JWS), JSON Web Encryption (JWE), JSON Web Token (JWT), and JSON Web Key (JWK). JWS lets deve
secured with a digital signature; JWE is used for encrypting the contents of a message; and JWT (which is being developed in the IETF's OAuth working group) is a way to represent claims or attributes between two entities. With JWT, t
are encoded as a JSON object, delivered as a payload protected by JWS or as ciphertext in a JWE package. The claims/attributes can be digitally signed and/or encrypted. JWK is a JSON
about those keys. It can represent RSA or Elliptic Curve-based keys." – John Fontana, zdnet.com, Jan. 21, 2013, http://www.zdnet.com/developers-getting-json-based-options-for-enterprise-authentication-7000010026/
2. OAuth, A simple, open standard, authentication method, http://oauth.net/
3. OpenID, Another, slightly more sophisticated third-party authentication method that allows uses to be authenticated by certain third-party sites, http://openid.net/
4. Custom authentication—some form of simple authentication using RESTful services.

Currently, ODOT is leaning towards JOSE authentication, but is looking for input from industry on optimal authentication methods.

For Encryption, ODOT is considering a 128- or 256-bit asymmetric encryption algorithm, the industry standards for financial transactions. ODOT is leaning towards JWE, which uses a 256-bit version of the AES algorithm.

Encryption and Authentication measures are not included in the interfaces specified in this document, such as the messages in JSON below. However, no RUC system will be implemented without message authentication and encryption. Any individuals reading this version of the ICD and desiring to know more about ODOT's planned security measures should contact ODOT.

4.2 Detailed Interface 1 Requirements

4.2.1 Interface 1 Requirements

The Mileage message is a cloud-based means of transmitting mileage data from the Mileage Collection subsystem to the Road Usage Charge Processing subsystem.

Application Layer: HTTP
Transport Layer: TCP
Internet Layer: IP
Web-services protocol: RESTful

Message definition: JSON

4.2.2 Interface Processing Time Requirements

The mileage message is sent by the Mileage Collection subsystem at a regular interval as specified in the Mileage Collection subsystem requirements.

4.2.3 Message (or File) Requirements

The Mileage Message is a push message from the Mileage Collection subsystem to the Road Usage Charge Processing subsystem. The Road Usage Charge Processing subsystem accepts the message at all times, whenever the Mileage Collection subsystem transmits it.

The message is sent by the Mileage Collection subsystem at an interval programmed into the Mileage Collection subsystem, as specified above in 4.1.1.

The Mileage message contains only mileage for one vehicle (VIN). If a MRD determines it has been inserted into a new vehicle but still has unsent mileage days in its buffer, it shall send these in one mileage message before it sends new mileage day records (for the new vehicle) in a new mileage message.

4.2.4 Data Message Characteristics

The data protocols are specified in 4.1 above.

Pseudocode of Mileage Message:

```
{
    MRDID                   // Unique MRD ID number – should correspond to VIN
    VIN                     // VIN of vehicle
    MsgID                   // Sequentially incrementing Message ID number
    MsgType                 // Regular message, or first or last message from vehicle
    Timestamp               // Time of Transmission from Data Collection Component
    MRDIssuer               // String of MRD Issuer Name
    MRDManufactuer          // String of MRD Manufacturer Name
    MRDConfigVersion        // Placeholder for MRD configuration version
    MapConfigVersion        // Placeholder for map configuration version
    FuelConsumptionData     // Boolean value indicating whether fuel consumption values are
                            // included by Data Collection in the Mileage Message

    // The following block of code is the mileage day record. For each mileage
    // message, include all days not yet transferred to transactions processor. All days
    // shall be included, even if value is 0.

    {
        Date
        MRDHealth               // MRD Health Code
        TotalMilesonDate        // Miles driven on reported date
        AccumMilesonDate        // Accumulated miles at end of date
        EstFuelConsumedonDate   // Optional field for estimated fuel consumed on date
        FuelAddedonDate         // Optional field for amount of fuel added on date

        // The following block of code is the mileage rule record. For each day (mileage
        // day record), include one instance of this block of each mileage rule ID in which
```

```
            // the vehicle has traveled. Basic MRDs will always only include one mileage rule
            // record per day using Mileage Rule ID code 00
            {
                MileageRuleID                // Code: 00 = Basic MRD miles & undifferentiated
                                             // miles for advanced MRD
                                             // Code 01-98 = FIPS code of travel state
                                             // Code 99 = Advanced MRD non-chargeable miles
                MilesinRuleID                // Miles traveled in MRID on date
                EstFuelConsumedinRuleID      // Optional field for estimate of fuel consumed
                FuelAddedinRuleID            // Optional field for amount of fuel added
                HealthinRuleID               // MRD Health Codes observed in RuleID on given
                                             // day
            }
        }
    }
}
```

Actual JSON Schema of message:

```
{
"$schema": "http://json-schema.org/draft-03/schema",
"required": false,
"type": "object" ,
"properties": {
    "RUCMSG" :
    {
    "required": true,
    "type": "object" ,
    "properties": {
        "RUCMSGinfo" :
        {
        "required": true,
        "type": "object" ,
        "properties": {
            "MRDID" :
            {
            "required": true,
            "type": "string"
            },
            "VIN" :
            {
            "required": true,
            "type": "string"
            },
            "MSGID" :
            {
            "required": true,
            "type": "string"
            },
            "MSGType" :
            {
            "required": true,
            "type": "string"
            },
            "Timestamp" :
            {
            "required": true,
            "type": "string"
            },
            "MRDIssuer" :
            {
```

```
        "required": true,
        "type": "string"
         },
         "MRDManufacturer" :
         {
        "required": true,
        "type": "string"
         },
         "MRDConfigVersion" :
         {
        "required": true,
        "type": "object" ,
        "properties": {
              "HWMainRelease" :
              {
             "required": true,
             "type": "string"
              },
              "HWSubRelease" :
              {
             "required": true,
             "type": "string"
              },
              "SWMainRelease" :
              {
             "required": true,
             "type": "string"
              },
              "SWSubRelease" :
              {
             "required": true,
             "type": "string"
              }
              }
         },
         "MapConfigVersion" :
         {
        "required": false,
        "type": "object" ,
        "properties": {
              "MapMainRelease" :
              {
             "required": true,
             "type": "string"
              },
              "MapSubRelease" :
              {
             "required": true,
             "type": "string"
              }
              }
         },
         "FuelConsumptionData" :
         {
        "required": false,
        "type": "string"
         }
         }
    },

    "RUCMSGcontent" :
    {
   "required": false,
   "type": "array" ,
   "items": [
         {
```

```
"required": false,
"type": "object" ,
"properties": {
    "MileageDayRecord" :
    {
   "required": true,
   "type": "object" ,
   "properties": {
        "RecordDate" :
        {
       "required": true,
       "type": "string"
        },
        "MRDHealth" :
        {
       "required": true,
       "type": "string"
        },
        "TotalMilesonDate" :
        {
       "required": true,
       "type": "string"
        },
        "AccumMilesonDate" :
        {
       "required": true,
       "type": "string"
        },
        "EstFuelConsumedonDate" :
        {
       "required": false,
       "type": "string"
        },
        "FuelAddedonDate" :
        {
       "required": false,
       "type": "number"
        },
        "MileageRuleRecord" :
        {
       "required": false,
       "type": "array" ,
       "items":
            {
           "required": false,
           "type": "object" ,
           "properties": {
                "MileageRuleID" :
                {
               "required": true,
               "type": "string"
                },
                "MilesinRuleID" :
                {
               "required": true,
               "type": "string"
                },
                "EstFuelConsumedinRuleID" :
                {
               "required": false,
               "type": "string"
                },
                "FuelAddedinRuleID" :
                {
               "required": false,
               "type": "string"
```

```
                    }
                    }
                }
            }
            }
        }
        }
    }
    ]
  }
  }
}
}
}
```

Pseudocode of Failure Message:

Note that the Failure Message shall only be transmitted by the RUCP if the mileage message fails data validation checks.

```
{
    Timestamp
    MSGID          // Message ID of failed mileage message received
    FailedDate     // Date of failed mileage message received
    MSGFailedCode  // Integer value indicating the reason for the message not being processed.

}
```

Actual JSON Schema of Failure Message:

```
{
"$schema": "http://json-schema.org/draft-03/schema",
"required": false,
"type": "object" ,
"properties": {
    "RUCMSGFailureMSG" :
    {
   "required": true,
   "type": "object" ,
   "properties": {
        "Timestamp" :
        {
       "required": true,
       "type": "string"
       },
        "MSGID" :
        {
       "required": true,
       "type": "string"
       },
        "FailedDate" :
        {
       "required": true,
       "type": "string"
       },
        "MSGFailedCode" :
        {
       "required": true,
       "type": "string"
       }
       }
}
```

}
}

4.2.5 Field / Element Definition

Data Element	Meaning
AccumMilesonDate	• Meaning: Accumulated Miles at end of date • Type: string • Quantization 4-byte decimal, [0,0.1,0.2…10,000,000.0]
EstFuelConsumedinRuleID	• Meaning: Optional field for an estimate of amount of fuel consumed in given rule ID on given day. Although the field name begins EstFuel, it may be a real measurement of fuel consumed • Type: string • Quantization 4-byte decimal, [0, 0.001, 0.002…10,000.000]
EstFuelConsumedonDate	• Meaning: Optional field for an estimate of amount of fuel consumed on given day. Although the field name begins EstFuel, it may be a real measurement of fuel consumed • Type: string • Quantization 4-byte decimal, [0, 0.001, 0.002…10,000.000]

FailedDate	• Meaning: date of failed Mileage Message transmission
	• Type: string
	• Quantization: The date is specified in the following form "YYYY-MM-DD" where:
	  o YYYY indicates the year
	  o MM indicates the month
	  o DD indicates the day

FuelAddedonDate	• Meaning: Optional field for amount of gasoline added on a given day • Type: string • Quantization 4-byte decimal, [0, 0.001, 0.002…10,000.000]

FuelConsumptionData	• Meaning: A Boolean value that indicates whether Data Collection has included fuel usage data in the Mileage Message. Note that for PEHVs, 0 is a valid value for Fuel Consumption.
	• Type: string
	• Quantization:
	  o 1: a valid ConsumedFuel value is included in the message to be used to compute fuel tax refunds
	  o 0: no Consumed Fuel data is included in the message, so fuel tax refunds will have to be estimated based upon miles traveled and the EPA combined city-highway fuel economy data for the vehicle.

HealthInRuleID	• Meaning: Code for MRD health record • Type: 2-byte integer [0..65535] • See quantization in MRDHealth below
HWMainRelease	• Meaning: HW primary release number • Type: string • Quantization: 3-byte string
HWSubRelease	• Meaning: HW secondary release number • Type: string • Quantization: 5-byte string

MapConfigVersion	• Meaning: Compound field comprised of:
	  o Map Main Release
	  o Map Sub Release
	• Type: complex Type, sequence

MapMainRelease	• Meaning: Map primary release number • Type: string • Quantization: 1-byte integer [0..255]
MapSubRelease	• Meaning: Map secondary release number • Type: string • Quantization: 1-byte integer [0..255]
MileageDayRecord	• Meaning: Mileage day record, with a record of date, MRD health for date, final accumulated miles by date, and for advanced MRDs, one Mileage Rule Record for each Mileage Rule traveled in on given date. A mileage message will contain one Mileage Day Record for each day of travel being transmitted in that mileage message. • Type: object

MileageRuleID	• Mileage Rule ID, numerical index for region of travel
	• Type: string of 4-byte integer [0.. 4294967296]
	• Encoding for Pilot
	  o 00 = Basic MRD miles & undifferentiated miles for advanced MRD
	  o 01-98 = FIPS code for state of travel
	  o 99 = Advanced MRD non-chargeable miles

MileageRuleRecord	• Mileage Rule Record for one day, mileage driven in mileage rule ID on specified day. A mileage day record will contain one Mileage Rule Record for each MRID in which travel occurred on that date. • Type = object
MilesinRuleID	• Meaning: Miles Traveled in Mileage Rule ID on given date • Type: string • Quantization 2-byte decimal, [0,0.1,0.2…6,553.5]

MRDConfigVersion	• Meaning: Compound field comprised of:
	  o HW Main Release
	  o HW Sub Release
	  o SW Main Release
	  o SW Sub Release
	• Type: Object

MRDHealth	• Meaning: Code for MRD health record • Type: string of 4-byte integer [0..65535] • Quantization: Bitwise Encoded. Set all bits that apply (i.e., bitwise OR each of the following). The first two bytes are set to all zeros, and the lower two bytes are set as follows: o 00000000 00000001 Low Voltage o 00000000 00000010 Anomalies in monitored vehicle functions and parameters which could compromise the collection and reporting of VMT data (e.g., MIL on - Check Engine light) o 00000000 00000100 Storage full o 00000000 00001000 Disconnects / reconnects (also including time of disconnect and reconnect and data on miles while disconnected if available) o 00000000 00010000 Connected to new vehicle o 00000000 00100000 Vehicle interface communications failure o 00000000 01000000 Location data degraded [advanced MRD only] o 00000000 10000000 Incorrect date/time (conflict between date/time from vehicle interface and from wireless communications) o 00000001 00000000 Software resets o 00000010 00000000 Software updates o 00000100 00000000 Degraded mileage data o 00001000 00000000 Missed mileage o 00010000 00000000 Vendor-specific o All remaining bits are reserved for future use.
MRDID	• Meaning: Unique MRD identification number • Type: string • Quantization: 16-byte ASCII string
MRDIssuer	• Meaning: Name of entity issuing MRD • Type: string • Quantization: 10-byte ASCII string
MRDManufacturer	• Meaning: Name of MRD Manufacturer • Type: string • Quantization: 10-byte ASCII string

MSGFailedCode	• Meaning: Value indicating either that the message was processed or if not, the reason for it not being processed. • Type: string • Quantization: 1-byte integer: 1. Failed Authentication 2. Duplicate message (a mileage message with identical MRDID and MSGID has already been received) • Data Inconsistency (other data consistency check failed)
MSGID	• Meaning: message identification number for sequencing of mileage messages • Type: string • Quantization: 4-byte integer: [0.. 4294967296]
MSGType	• Meaning: indicator of whether the mileage message is a normal message, or the first message from a vehicle/VIN, or the last message from a vehicle/VIN • Quantization: 1-byte integer o 0=normal message o 1=First Message from vehicle o 2=Last Message from vehicle • 3=Disconnected from vehicle
RecordDate	• Meaning: date of Mileage Day Record • Type: string • Quantization: The date is specified in the following form "YYYY-MM-DD" where: o YYYY indicates the year o MM indicates the month o DD indicates the day
SWMainRelease	• Meaning: SW primary release number • Type: string • Quantization: 3-byte string
SWSubRelease	• Meaning: SW secondary release number • Type: string • Quantization: 5-byte string

Timestamp	• Meaning: timestamp provided by transmitting entity when message sent. When message sends fail, the Timestamp is updated to the current time when the message is resent.
	• Type: string
	• Quantization: The date Time is specified in the following form "YYYY-MM-DDT hh:mm:ss" where:
	  o YYYY indicates the year
	  o MM indicates the month
	  o DD indicates the day
	  o T indicates the start of the required time section
	  o hh indicates the hour
	  o mm indicates the minute
	  o ss indicates the second

TotalMilesonDate	• Meaning: Total Miles Reported for the vehicle on the reporting date • Type: string • Quantization 4-byte decimal, [0,0.1,0.2…10,000,000.0]
VIN	• Meaning: The VIN of the vehicle in which the MRD is installed • Type: string • Quantization: 17-byte string of ASCII text

4.2.6 Communication Methods

Any communications method that can employ the protocols specified in 4.1 is appropriate. For example, Wi-Fi, 3G, 4G, and fixed-line Internet are all appropriate communications methods.

4.2.7 Interface Initiation

The interface is initiated by the Mileage Collection subsystem at regular intervals as specified in the requirements of the Mileage Collection subsystem.

4.2.8 Flow Control

Flow control occurs as specified in the protocols included in 4.1 above.

4.3 Qualification Methods

Interface 1 can be qualified by a test.

A reference Road Usage Charge Processing subsystem will be set up that complies with the specification herein, and when a Mileage Collection subsystem to be tested is proposed, it simply needs to use the address of the reference Road Usage Charge Processing subsystem.

5. Interface 2 – Road Usage Charge Processing to Road Usage Charge Accounting

5.1 Interface 2 Overview

Interface 2, RUCP to RUCA is an exchange of data tables. In full implementation, it will be an automated electronic process. However, for the pilot project, it was sufficient to have an exchange of spreadsheets.

5.1.1 Business Process

For interface 2, the Road Usage Charge Processing subsystem will submit data tables to the Road Usage Charge Accounting subsystem on a regular, periodic basis, specified by the RUCA subsystem. The Road Usage Charge Processing subsystem has a process in place to assemble the data.

5.1.2 Data Transfer

For Interface 2, the Road Usage Charge Processing subsystem will send the data tables to the Road Usage Charge Accounting subsystem via e-mail. The frequency of transmission will be specified by the RUCA subsystem.

5.1.3 Transactions

For Interface 2, transactions are comprised of three data tables being e-mailed from the Road Usage Charge Processing subsystem to the RUCA subsystem.

5.1.4 Security and Integrity

Message security considerations are identical to those for the mileage message discussed in 4.1.4 above.

5.2 Detailed Interface Requirements

5.2.1 Interface 2 Requirements

There are three data flows that are transmitted from the Road Charge Processing subsystem to the ODOT Road Usage Charge Accounting subsystem. The three data flows are:

1. Transfer of Summary Mileage and RUC Revenue report to the Oregon Department of Transportation (RUCA) on a periodic basis (M&RR report).
2. A summary list of all VINs and related data managed by CSPs to the Oregon Department of Transportation on a periodic basis (VIN Summary Report).
3. An Errors and Events Report, which provides exception (or health) codes on Mileage Collection/CSP hardware or data gathering to monitor performance of the system.

5.2.2 Interface Processing Time Requirements

The periodic transfer interval shall be defined by ODOT.

5.2.3 Message (or File) Requirements

The electronic format of this data shall be a spreadsheet.

5.2.4 Data Message Characteristics

<u>Data Flow 1: Mileage and RUC Revenue (M&RR) Payment Report</u>

The Summary Mileage and RUC Revenue Report shall contain a record of the start and end times of the period, a list of all Mileage Rule IDs in which travel was recorded, and a list of RUC due for that mileage traveled. It shall also contain totals of that value.

It shall be composed as a JSON message just as the Mileage message was.

Pseudocode of M&RR Message:

```
{
    CSPID                 // Unique CSP ID
    Timestamp             // Timestamp of report transmission
    PeriodStartDate       // Start date of period for report
    PeriodEndDate         // End date of period for report

    // The following block of code is the mileage rule M&RR record.

    {
        MileageRuleID     // Code: 00 = Basic MRD miles & undifferentiated
                          // miles for advanced MRD
                          // Code 01-98 = FIPS code of travel state
                          // Code 99 = Advanced MRD non-chargeable miles
        MilesInRuleID     // Total Miles traveled in MRID for report
        RateInRuleID      // Rate at which miles were charged
        RevenueInRuleID// Total Revenue for MRID
        FuelUsageInRuleID//Total fuel used in Rule ID
        FuelRateInRuleID  //Rate of fuel credit given for fuel in MRID
        FuelTaxCreditInRuleID // Amount of fuel credit given in RuleID.
        InvoiceInRuleID  // Total Invoice in RuleID
    }

    TotalMileage // Total miles for report
    TotalRevenue // Total revenue for report
    TotalFuelUsage// Total fuel usage for report (gal)
    TotalFuelTaxCredit// Total fuel tax credit for report
    TotalInvoice // Total invoice for report.
    }
  }
}
```

Actual JSON Schema of message:

```
{
"$schema": "http://json-schema.org/draft-03/schema",
"required": false,
"type": "object" ,
"properties": {
    "MAndRRMSG" :
    {
   "required": true,
   "type": "object" ,
   "properties": {
        "MAndRRMSGinfo" :
        {
       "required": true,
       "type": "object" ,
```

```
"properties": {
      "CSPID" :
      {
     "required": true,
     "type": "string"
      },
      "Timestamp" :
      {
     "required": true,
     "type": "string"
      },
      "PeriodStartDate" :
      {
     "required": true,
     "type": "string"
      },
      "PeriodEndDate" :
      {
     "required": true,
     "type": "string"
      }
      }
 },
 "MAndRRMSGcontent" :
 {
"required": false,
"type": "array" ,
"items": [
      {
     "required": false,
     "type": "object" ,
     "properties": {
           "MileageRuleMRRRecord" :
           {
          "required": true,
          "type": "object" ,
          "properties": {
                "MileageRuleID" :
                {
               "required": true,
               "type": "string"
                },
                "MilesInRuleID" :
                {
               "required": true,
               "type": "string"
                },
                "RateInRuleID" :
                {
               "required": true,
               "type": "string"
                },
                "RevenueInRuleID" :
                {
               "required": true,
               "type": "string"
                },
                "FuelUsageInRuleID" :
                {
               "required": true,
               "type": "string"
                },
                "FuelRateInRuleID" :
                {
               "required": false,
               "type": "string"
```

```
                    },
                    "FuelTaxCreditInRuleID" :
                    {
                   "required": true,
                   "type": "string"
                    },
                    "InvoiceInRuleID" :
                    {
                   "required": false,
                   "type": "string"
                    }
                }
                }
            }
            }
            ],
            "TotalMileage" :
            {
            "required": true,
            "type": "string"
            },
            "TotalRevenue" :
            {
            "required": true,
            "type": "string"
            },
            "TotalFuelUsage" :
            {
            "required": true,
            "type": "string"
            },
            "TotalFuelTaxCredit" :
            {
            "required": true,
            "type": "string"
            },
            "TotalInvoice" :
            {
            "required": true,
            "type": "string"
            }
        }
    }
    }
}
}
```


Data Element	Meaning
CSPID	• Meaning: CSP identifier (name or number) • Type: string
FuelRateInRuleID	• Meaning: Fuel Tax Credit rate per gallon in given MRID for given period for all VINs in dollars • Type: string • Quantization: 0.01, 0.02 … 99,999,999.99
FuelTaxCreditInRuleID	• Meaning: Fuel Tax Credit in given MRID for given period • Type: string • Quantization: 0.01, 0.02, … , 2.55

FuelUsageInRuleID	• Meaning: Fuel Usage in given MRID for given period in gallons for all VINs • Type: string • Quantization: 0.01, 0.02, 99,999,999.99
InvoiceInRuleID	• Meaning: Amount invoiced in given MRID for given period for all VINs • Type: string • Quantization: 0.01, 0.02, … , 99,999,999.99

MileageRuleID	• Mileage Rule ID, numerical index for region of travel
	• Type: string of 4-byte integer [0.. 4294967296]
	• Encoding for Pilot
	  o 00 = Basic MRD miles & undifferentiated miles for advanced MRD
	  o 01-98 = FIPS code for state of travel
	  o 99 = Advanced MRD non-chargeable miles

MileageRuleRecord	• Data for Mileage Rule ID for given period • Type = object
MilesinRuleID	• Meaning: Miles Traveled in Mileage Rule ID for given period • Type: string • Quantization [0,0.1,0.2…99,999,999.99]

PeriodStartDate	• Meaning: date of start of period
	• Type: string
	• Quantization: The date is specified in the following form "YYYY-MM-DD" where:
	  o YYYY indicates the year
	  o MM indicates the month
	  o DD indicates the day

PeriodEndDate	• Meaning: date of end of period
	• Type: string
	• Quantization: The date is specified in the following form "YYYY-MM-DD" where:
	  o YYYY indicates the year
	  o MM indicates the month
	• DD indicates the day

RateInRuleID	• Meaning: RUC per mile charge in given MRID for given period in dollars • Type: string • Quantization: 0.0001, 0.0002, … , 6.5535
RevenueInRuleID	• Meaning: RUC Revenue in given MRID for given period in dollars • Type: string • Quantization: 0.01, 0.02, … , 99,999,999.99
TotalFuelTaxCredit	• Meaning: Total Fuel Tax Credit for all MRIDs for given period for all VINs in dollars • Type: string • Quantization: 0.01, 0.02 … 99,999,999.99

TotalFuelUsage	• Meaning: Total fuel Usage in given MRID for given period in gallons • Type: string • Quantization: 0.01, 0.02, 99,999,999.99
TotalInvoice	• Meaning: Total Amount invoiced for all MRIDs for given period for all VINs • Type: string • Quantization: 0.01, 0.02, … , 99,999,999.99
TotalMileage	• Meaning: Total Miles Traveled in Mileage Rule ID for given period • Type: string • Quantization [0,0.1,0.2…99,999,999.99]
TotalRevenue	• Meaning: Total RUC Revenue in for all MRIDs for given period in dollars • Type: string • Quantization: 0.01, 0.02, … , 99,999,999.99
Timestamp	• Meaning: timestamp provided by transmitting entity when message sent. When message sends fail, the Timestamp is updated to the current time when the message is resent. • Type: string • Quantization: The date Time is specified in the following form "YYYY-MM-DDT hh:mm:ss" where: o YYYY indicates the year o MM indicates the month o DD indicates the day o T indicates the start of the required time section o hh indicates the hour o mm indicates the minute o ss indicates the second
VIN	• Meaning: The VIN of the vehicle in which the MRD is installed • Type: string • Quantization: 17-byte string of ASCII text

<u>Data Flow 2: VIN Report</u>

The VIN report includes travel records for each vehicle/VIN registered with the CSP. In the VIN Report, an VIN Status code is given for each vehicle, and in addition the time that activity code was achieved. The VIN status code is defined as follows:

a. For VINs that are in the RUCP database for the entire period, the VIN Status code is “Continuing”.

b. For VINs that are added to the RUCP database during the period, the VIN Status code is “Added”, and the Add Date is specified.

c. For VINs that are deleted from the RUCP database during the period, the VIN Status code is "Deleted", and the Delete Date is specified.

Pseudocode of VIN Report Message:

```
{
    CSPID                   // Unique CSP ID number
    Timestamp               // Timestamp of report transmission
    PeriodStartDate         // Start date of period for report
    PeriodEndDate           // End date of period for report

    // The following block of code is the VIN record. Include one for each VIN in report.

    {
        VIN                         // Vehicle VIN
        MRDID                       // Total Miles traveled in MRID for report
        MRDIssuer                   // Rate at which miles were charged
        MRDManufacturer             // Name of Manufacturer of MRD
        MRDConfigVersion            // HW and SW configuration of MRD
        VINStatus                   //Continuing, added, deleted
        DateofVINStatus             //Date upon which status was effective
        ReasonForExit               // Reason for exiting
        FuelUseMeasurement      //True = fuel use measured; False = fuel use estimated
        TotalVINMiles               // Amount of fuel credit given in RuleID.
        TotalVINFuelUse             // Total Fuel Use for VIN
        TotalVINInvoice             // Total Invoice for VIN

        // The following is the VIN mileage rule record. Include one for each MRID in
        // which the VIN is active in the given period

        {
            MileageRuleID       // Code: 00 = Basic MRD miles & undifferentiated
                                // miles for advanced MRD
                                // Code 01-98 = FIPS code of travel state
                                // Code 99 = Advanced MRD non-chargeable miles
            VINMilesInRuleID    // Total Miles traveled in MRID for report
            VINRevenueInRuleID// Total Revenue for MRID
            VINFuelUsageInRuleID//Total fuel used in Rule ID
            VINFuelTaxCreditInRuleID // Amount of fuel credit given in RuleID.
            VINInvoiceInRuleID  // Total Invoice in RuleID
        }
    }

    // The following is the MRID Total record. Include one for each MRID in the report

    {
            MileageRuleID       // Code: 00 = Basic MRD miles & undifferentiated
                                // miles for advanced MRD
                                // Code 01-98 = FIPS code of travel state
```

// Code 99 = Advanced MRD non-chargeable miles
TotalMileageInRuleID // Total Miles traveled in MRID for report
RateInRuleID **//** Rate at which miles were charged
TotalRevenueInRuleID// Total Revenue for MRID
TotalFuelUsageInRuleID//Total fuel used in Rule ID
FuelRateInRuleID **//**Rate of fuel credit given for fuel in MRID
TotalFuelTaxCreditInRuleID // Amount of fuel credit given in RuleID.
TotalInvoiceInRuleID **//** Total Invoice in RuleID
}

TotalMileage // Total miles for report
TotalRevenue // Total revenue for report
TotalFuelUsage// Total fuel usage for report (gal)
TotalFuelTaxCredit// Total fuel tax credit for report
TotalInvoice // Total invoice for report.
}
}
}

Actual JSON Schema of message:


```
{
"$schema": "http://json-schema.org/draft-03/schema",
"required": false,
"type": "object" ,
"properties": {
    "VINMSG" :
    {
    "required": true,
    "type": "object" ,
    "properties": {
        "VINMSGinfo" :
        {
        "required": true,
        "type": "object" ,
        "properties": {
            "CSPID" :
            {
            "required": true,
            "type": "string"
            },
            "Timestamp" :
            {
            "required": true,
            "type": "string"
            },
            "PeriodStartDate" :
            {
            "required": true,
            "type": "string"
            },
            "PeriodEndDate" :
            {
            "required": true,
            "type": "string"
            }
            }
        },
        "VINMSGcontent" :
```

```
 {
"required": false,
"type": "array" ,
"items": [
      {
     "required": false,
     "type": "object" ,
     "properties": {
          "VINRecord" :
          {
         "required": true,
         "type": "object" ,
         "properties": {
              "VIN" :
              {
             "required": true,
             "type": "string"
              },
              "MRDID" :
              {
             "required": true,
             "type": "string"
              },
              "MRDIssuer" :
              {
             "required": true,
             "type": "string"
              },
              "MRDManufacturer" :
              {
             "required": true,
             "type": "string"
              },
             "MRDConfigVersion" :
             {
             "required": true,
             "type": "object" ,
             "properties": {
                  "HWMainRelease" :
                  {
                  "required": true,
                  "type": "string"
                  },
                  "HWSubRelease" :
                  {
                  "required": true,
                  "type": "string"
                  },
                  "SWMainRelease" :
                  {
                  "required": true,
                  "type": "string"
                  },
                  "SWSubRelease" :
                  {
                  "required": true,
                  "type": "string"
                  }
                  }
             },

              "VINStatus" :
              {
             "required": true,
             "type": "string"
              },
```

```
 "DateOfVINStatus" :
 {
"required": false,
"type": "string"
 },
 "ReasonForExit" :
 {
"required": true,
"type": "string"
 },
 "FuelUseMeasurement" :
 {
"required": false,
"type": "string"
 },
 "TotalVINMiles" :
 {
"required": false,
"type": "string"
 },
 "TotalVINFuelUse" :
 {
"required": true,
"type": "string"
 },
 "TotalVINInvoice" :
 {
"required": false,
"type": "string"
 },
 "required": false,
 "type": "array" ,
 "items": [
        {
        "required": false,
        "type": "object" ,
        "properties": {
                "VINMileageRuleRecord" :
                {
                "required": true,
                "type": "object" ,
                "properties": {
                        "MileageRuleID" :
                        {
                        "required": true,
                        "type": "string"
                        },
                        "VINMilesInRuleID" :
                        {
                        "required": true,
                        "type": "string"
                        },
                        "VINRevenueInRuleID" :
                        {
                        "required": true,
                        "type": "string"
                        },
                        "VINFuelUsageInRuleID" :
                        {
                        "required": true,
                        "type": "string"
                        },
                        "VINFuelTaxCreditInRuleID" :
                        {
                        "required": true,
                        "type": "string"
```

```
                                        },
                                        "VINInvoiceInRuleID" :
                                        {
                                        "required": true,
                                        "type": "string"
                                        }
                                        }
                                }
                                }
                                }
                                ]
                        }
                        }
                }
                }
                },
        "required": false,
        "type": "array" ,
        "items": [
                {
                "required": false,
                "type": "object" ,
                "properties": {
                        "MRIDTotalRecord" :
                        {
                        "required": true,
                        "type": "object" ,
                        "properties": {
                                "MileageRuleID" :
                                {
                                "required": true,
                                "type": "string"
                                },
                                "TotalMileageInRuleID" :
                                {
                                "required": true,
                                "type": "string"
                                },
                                "RateInRuleID" :
                                {
                                "required": true,
                                "type": "string"
                                },
                                "TotalRevenueInRuleID" :
                                {
                                "required": true,
                                "type": "string"
                                },
                                "TotalFuelUsageInRuleID" :
                                {
                                "required": true,
                                "type": "string"
                                },
                                "FuelRateInRuleID" :
                                {
                                "required": true,
                                "type": "string"
                                },
                                "TotalFuelTaxCreditInRuleID" :
                                {
                                "required": true,
                                "type": "string"
                                },
                                "TotalInvoiceInRuleID" :
                                {
                                "required": true,
```

```
                                                "type": "string"
                                                }
                                        }
                                        }
                                }
                                }
                                ]
                },
                "TotalMileage" :
                {
                "required": true,
                "type": "string"
                },
                "TotalRevenue" :
                {
                "required": true,
                "type": "string"
                },
                "TotalFuelUsage" :
                {
                "required": true,
                "type": "string"
                },
                "TotalFuelTaxCredit" :
                {
                "required": true,
                "type": "string"
                },
                "TotalInvoice" :
                {
                "required": true,
                "type": "string"
                }
                }
        }
        }
}
```

Data Element	Meaning
CSPID	• Meaning: CSP identifier (name or number) • Type: string

DateofVINStatus	• Meaning: date upon which VIN status (new or deleted) was effective)
	• Type: string
	• Quantization: The date is specified in the following form "YYYY-MM-DD" where:
	  o YYYY indicates the year
	  o MM indicates the month
	• DD indicates the day

FuelRateInRuleID	• Meaning: Fuel Tax Credit rate in dollars per gallon in given MRID for given period • Type: string • Quantization: 0.01, 0.02, … , 2.55

FuelUseMeasurement	• Meaning: Boolean of weather fuel use was measured or calculated.
	• Type: string
	• Quantization:
	  o T = True (fuel use estimated based on measured values)
	  o F = False (fuel use calculated based on miles driven)

HWMainRelease	• Meaning: HW primary release number • Type: string • Quantization: 3-byte string
HWSubRelease	• Meaning: HW secondary release number • Type: string • Quantization: 5-byte string
InvoiceInRuleID	• Meaning: Amount invoiced in given MRID for given period for all VINs • Type: string • Quantization: 0.01, 0.02, … , 99,999,999.99
MilesinRuleID	• Meaning: Miles Traveled in Mileage Rule ID for given period • Type: string • Quantization [0,0.1,0.2…99,999,999.99]

MileageRuleID	• Mileage Rule ID, numerical index for region of travel
	• Type: string of 4-byte integer [0.. 4294967296]
	• Encoding for Pilot
	  o 00 = Basic MRD miles & undifferentiated miles for advanced MRD
	  o 01-98 = FIPS code for state of travel
	  o 99 = Advanced MRD non-chargeable miles

MileageRuleRecord	• Mileage Rule Record for one day, mileage driven in mileage rule ID on specified day. A mileage day record will contain one Mileage Rule Record for each MRID in which travel occurred on that date. • Type = object

MRDConfigVersion	• Meaning: Compound field comprised of:
	  o HW Main Release
	  o HW Sub Release
	  o SW Main Release
	  o SW Sub Release
	• Type: Object

MRDID	• Meaning: Unique MRD identification number • Type: string • Quantization: 16-byte ASCII string
MRDIssuer	• Meaning: Name of entity issuing MRD • Type: string • Quantization: 10-byte ASCII string

MRDManufacturer	• Meaning: Name of MRD Manufacturer • Type: string • Quantization: 10-byte ASCII string
PeriodStartDate	• Meaning: date of start of period • Type: string • Quantization: The date is specified in the following form "YYYY-MM-DD" where: o YYYY indicates the year o MM indicates the month • DD indicates the day
PeriodEndDate	• Meaning: date of end of period • Type: string • Quantization: The date is specified in the following form "YYYY-MM-DD" where: o YYYY indicates the year o MM indicates the month • DD indicates the day
RateInRuleID	• Meaning: RUC charge per mile in dollars in given MRID for given period • Type: string • Quantization: 0.01, 0.02, … , 2.55
ReasonforExit	• Meaning: The reason given by the driver for exiting the given CSP (for VINStatus = deleted only) • Type: String
SWMainRelease	• Meaning: SW primary release number • Type: string • Quantization: 3-byte string
SWSubRelease	• Meaning: SW secondary release number • Type: string • Quantization: 5-byte string
TotalFuelTaxCredit	• Meaning: Total Fuel Tax Credit for all MRIDs for given period for all VINs in dollars • Type: string • Quantization: 0.01, 0.02 … 99,999,999.99
TotalFuelTaxCreditInRuleID	• Meaning: Total Fuel Tax Credit in MRID for given period for all VINs in dollars • Type: string • Quantization: 0.01, 0.02 … 99,999,999.99
TotalFuelUsage	• Meaning: Total fuel Usage in all MRIDs for given period in gallons • Type: string • Quantization: 0.01, 0.02, 99,999,999.99
TotalFuelUsageInRuleID	• Meaning: Total fuel Usage in given MRID for given period in gallons • Type: string • Quantization: 0.01, 0.02, 99,999,999.99

TotalInvoice	• Meaning: Total Amount invoiced for all MRIDs for given period for all VINs • Type: string • Quantization: 0.01, 0.02, … , 99,999,999.99
TotalInvoiceInRuleID	• Meaning: Total Amount invoiced in given MRID for given period for all VINs • Type: string • Quantization: 0.01, 0.02, … , 99,999,999.99
TotalMileage	• Meaning: Total Miles Traveled in all Mileage Rule IDs for given period • Type: string • Quantization [0,0.1,0.2…99,999,999.99]
TotalMileageInRuleID	• Meaning: Total Miles Traveled in given Mileage Rule ID for given period • Type: string • Quantization [0,0.1,0.2…99,999,999.99]
TotalRevenue	• Meaning: Total RUC Revenue in for all MRIDs for given period in dollars • Type: string • Quantization: 0.01, 0.02, … , 99,999,999.99
TotalRevenueInRuleID	• Meaning: Total RUC Revenue in given MRID for given period in dollars • Type: string • Quantization: 0.01, 0.02, … , 99,999,999.99
TotalVINFuelUse	• Meaning: Total Fuel Usage in all MRIDs for given VIN • Type: string • Quantization: 0.01, 0.02, 9,999.99
TotalVINInvoice	• Meaning: Amount invoiced for all MRIDs for given period for given VIN • Type: string • Quantization: 0.01, 0.02, … , 9,999.99
TotalVINMiles	• Meaning: Total Miles Traveled in Mileage Rule ID for given VIN • Type: string • Quantization 2-byte decimal, [0,0.1,0.2… 99,999.99]

Timestamp	• Meaning: timestamp provided by transmitting entity when message sent. When message sends fail, the Timestamp is updated to the current time when the message is resent. • Type: string • Quantization: The date Time is specified in the following form "YYYY-MM-DDT hh:mm:ss" where: o YYYY indicates the year o MM indicates the month o DD indicates the day o T indicates the start of the required time section o hh indicates the hour o mm indicates the minute o ss indicates the second
VIN	• Meaning: The VIN of the vehicle in which the MRD is installed • Type: string • Quantization: 17-byte string of ASCII text
VINFuelTaxCreditInRuleID	• Meaning: Fuel Tax Credit in given MRID for given VIN for given period • Type: string • Quantization: 0.01, 0.02, … , 9,999.99
VINFuelUsageInRuleID	• Meaning: Fuel Usage in given MRID for given period in gallons for all VINs • Type: string • Quantization: 0.01, 0.02, 9,999.99
VINInvoiceInRuleID	• Meaning: Amount invoiced in given MRID for given period for given VIN • Type: string • Quantization: 0.01, 0.02, … , 9,999.99
VINMilesinRuleID	• Meaning: Miles Traveled in Mileage Rule ID • Type: string • Quantization 2-byte decimal, [0,0.1,0.2… 9,999.99]
VINFuelTaxCreditInRuleID	• Meaning: Fuel Tax Credit in given MRID for given VIN for given period • Type: string • Quantization: 0.01, 0.02, … , 9,999.99
VINStatus	• Meaning: status of given VIN: Added (first time appearing on report), Deleted (last time appearing on report), Continuing (neither added nor deleted) • Type: string • Quantization: C = continuing, A= added, D= deleted

The VIN summary report does not preclude the RUCA requesting more detailed mileage information on all vehicles. The RUCA may request that the CSPs provide all mileage

messages for a specified set of VINs for a specified range of dates, as mentioned in the requirements document.

Data Flow 3: Error and Events Report List

The Error and Events Report List shall contain the codes detected and attached to transaction records. These codes include health codes for the MRD, anomalies detected during CSP processing or Vehicle Status (or activity) codes for participants of each CSP.

Pseudocode of Errors and Events Report Message:

```
{
    CSPID                   // Unique CSP ID number
    Timestamp               // Timestamp of report transmission
    PeriodStartDate         // Start date of period for report
    PeriodEndDate           // End date of period for report

    // The following block of code is the VIN record. Include one for each VIN in report.

    {
        VIN                         // Vehicle VIN
        MRDID                       // Total Miles traveled in MRID for report
        MRDIssuer                   // Rate at which miles were charged
        MRDManufacturer             // Total Revenue for MRID
        MRDConfigVersion            // HW and SW version for MRD

        // The following block of code is the VIN day error and event record. Include one for
        // each day for which an error or event occurred.

        {
            ErrorEventDate          // Date of Error Event Record.
            ErrorEventCode          // 4-byte encoding of all errors and events
        }
    }
}
```

```
{
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            "required": true,
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            },
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      "type": "string"
        },
        "PeriodEndDate" :
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        }
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          "required": true,
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          "type": "string"
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```
                    "ErrorEventCode" :
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                    }
                }
                }
                }
                ]
            }
            }
        }
        }
        ]
}
}
}
}
```

Data Element	Meaning
CSPID	• Meaning: CSP identifier (name or number) • Type: string

ErrorEventCodeMRD	• Meaning: Coding of all errors and events that occurred for the given MRD on the given date, when the error was detected by the MRD • Type: String • Quantization: 4-byte bitwise OR of various error and event codes, as follows: (each of the following codes represents a bit in a 4-byte code that is comprised of a bitwise OR of all code that occurred that day. 1 is the low bit, ie 1 = 00000000 00000000 00000000 00000001, 2 = 00000000 00000000 00000000 00000010, etc) 1. Low Voltage 2. Anomalies in monitored vehicle functions and parameters which could compromise the collection and reporting of VMT data (e.g., MIL on - Check Engine light) 3. Storage full 4. Disconnects / reconnects (also including time of disconnect and reconnect and data on miles while disconnected if available) 5. Connected to new vehicle 6. Vehicle interface communications failure 7. Location data degraded [advanced MRD only] 8. Incorrect date/time (conflict between date/time from vehicle interface and from wireless communications) 9. Software resets 10. Software updates 11. Degraded mileage data 12. Missed mileage 13. Vendor-specific Bits 14-32 are reserved for future use.

ErrorEventCodeRUCP	• Meaning: Coding of all errors and events that occurred for the given MRD on the given date, when the error was detected by the RUCP • Type: String • Quantization: 4-byte bitwise OR of various error and event codes, as follows: Codes generated by RUCP (each of the following codes represents a bit in a 4-byte code that is comprised of a bitwise OR of all code that occurred that day. 1 is the low bit, ie 1 = 00000000 00000000 00000000 00000001, 2 = 00000000 00000000 00000000 00000010, etc): 1. No message received from MRD. 2. Unreadable Message from MRD / Checksum failure 3. MessageIDs from MRD not correctly incrementing. 4. VIN - MRD ID mismatch. 5. Date/time not increasing from last message 6. Accumulated Mileage decreased from last message. 7. New total mileage does not equal sum of mileage in zones 8. Invalid Mileage Rule ID (“Zone”) Bits 9-32 are reserved for future use.
ErrorEventDate	• Meaning: date of error or event • Type: string • Quantization: The date is specified in the following form "YYYY-MM-DD" where: o YYYY indicates the year o MM indicates the month • DD indicates the day
HWMainRelease	• Meaning: HW primary release number • Type: string • Quantization: 3-byte string
HWSubRelease	• Meaning: HW secondary release number • Type: string • Quantization: 5-byte string

MRDConfigVersion	• Meaning: Compound field comprised of:
	  o HW Main Release
	  o HW Sub Release
	  o SW Main Release
	  o SW Sub Release
	• Type: Object

MRDID	• Meaning: Unique MRD identification number • Type: string • Quantization: 16-byte ASCII string
MRDIssuer	• Meaning: Name of entity issuing MRD • Type: string • Quantization: 10-byte ASCII string
MRDManufacturer	• Meaning: Name of MRD Manufacturer • Type: string • Quantization: 10-byte ASCII string

PeriodStartDate	• Meaning: date of start of period
	• Type: string
	• Quantization: The date is specified in the following form "YYYY-MM-DD" where:
	  o YYYY indicates the year
	  o MM indicates the month
	• DD indicates the day

PeriodEndDate	• Meaning: date of end of period
	• Type: string
	• Quantization: The date is specified in the following form "YYYY-MM-DD" where:
	  o YYYY indicates the year
	  o MM indicates the month
	• DD indicates the day

SWMainRelease	• Meaning: SW primary release number • Type: string • Quantization: 3-byte string
SWSubRelease	• Meaning: SW secondary release number • Type: string • Quantization: 5-byte string

Timestamp	• Meaning: timestamp provided by transmitting entity when message sent. When message sends fail, the Timestamp is updated to the current time when the message is resent. • Type: string • Quantization: The date Time is specified in the following form "YYYY-MM-DDT hh:mm:ss" where: o YYYY indicates the year o MM indicates the month o DD indicates the day o T indicates the start of the required time section o hh indicates the hour o mm indicates the minute o ss indicates the second
VIN	• Meaning: The VIN of the vehicle in which the MRD is installed • Type: string • Quantization: 17-byte string of ASCII text

5.2.5 Field / Element Definition

See above.

5.2.6 Communication Methods

The method of transfer shall be secure VPN, using encryption and authentication as discussed.

5.2.7 Interface Initiation

The CSP shall initiate the interfaces with the RUCA as agreed to in the contract.

5.2.8 Flow Control

Not applicable.

5.2.9 Reports

In addition to sending the three spreadsheets specified here each month, the RUCP contractor shall have the ability to generate and save in spreadsheet format on-line reports monitoring the performance of their systems. When the RUCA requests these reports, these reports shall be emailed to RUCA providers for review and evaluation.

Reports that RUCA providers may request shall include, but not be limited to:

- Event logs – for use in recording and documenting ongoing issues. Reports shall be due immediately on realization of each occurrence and should include at a minimum:
    - Date of occurrence
    - Type of failure

        - Detail description of failure
        - Cause of failure
        - Action taken to resolve of failure
        - Likely recurrence of failure
        - Other comments
    - Report on Transmittal of Road Usage Charges with Zone mileage
        - Includes mileage by Mileage Rule ID
        - Mileage rate by Mileage Rule ID
        - Road Usage Charges due by Mileage Rule ID.
        - Total mileage
        - Total Road Usage Charge transferred to RUCA (and State Treasurer, if applicable)
    - Inventory of VIN and owner's name records assigned
        - List of VINs and owners names in RCPs database
    - Data capture for all assigned participants
        - A report listing daily receipt of reports for each participant registered with given RUCP, including list of days for which no report was received
    - End of day confirmations
        - Shows that all mileage messages received on a given day have been posted to user accounts.
        - Shows that, by day, travel in all mileage Rule IDs from messages received on that day equals amount of travel posted to user accounts.
    - End of period confirmation
        - Shows that all travel for user accounts for the period has been posted.
        - Shows that all travel in all Mileage RuleIDs travel equals amount of all travel in Mileage Rule ID posted to user accounts
        - Shows that all travel in all Mileage RuleIDs in RUCP system equals travel in all Mileage RuleIDs travel reported to RUCA.

5.3 Qualification Methods

Interface 2 can be qualified by inspection. When the CSP submits spreadsheets, the Road Usage Charge Accounting subsystem can determine if they are compliant to this specification.