



CARSTM

Frequently Asked Questions



INTRODUCTION

Rieker Inc., the leader in ball-bank instruments, introduced in 2014 the only service for establishing uniform safe advisory safe curve signage at a Nation-wide level that would accomplish the Federal Highway Administration's 2019 mandate, specifically for roadway curve signing.

1. **SAFETY FIRST** - Allows driving with traffic - any speed.
2. **UNIFORMITY** - Meets FHWA 2009 MUTCD requirements.
3. **ON-TIME Project Completion** - saves man hours & budget.

Now available through authorized fully trained and certified service providers - complete turnkey to State-wide enterprise to project based solutions.

Call us today to find the service provider in your state - **800-497-4523** - and learn how Rieker CARS™ Solution will help you meet the FHWA mandate for re-surveying all required roadway horizontal curves by 2019.

The Curve Advisory Reporting Service (CARS™) for:

- FHWA 2009 MUTCD requirements
- FHWA horizontal curve re-sign 2019 mandate
- Driving with traffic - one pass - any speed
- Automatically calculates safe curve speed
- Short-term or Long-term road survey project

To learn more about our products or services, email at inquiry@riekerinc.com or call us today at **610-500-2000**.

CARS Solution Online...

Find out more www.riekerinc.com/CurveAdvisoryReporting.htm



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1 GENERAL INFORMATION

Q Is it accepted by the Federal Highway Administration (FHWA)?

- A** Yes, the CARS system is based on the proven and approved RDS7-BB-09 platform and the methodologies recommended by the FHWA
http://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa1122/ch3.cfm

Q What are the Federal Highway Administration 2009 MUTCD Compliance Dates?

- A** The compliance date as set forth in the FHWA 23 CFR Part 655, FHWA Docket No. FHWA-2010-0159, per table 2C: December 31, 2019.

Q Do I have to resurvey the roadways and curves if the MUTCD criteria change?

- A** No. The roadways, including curves already driven and recorded with CARS, will not have to be re-driven or field analyzed as the CARS' software functionality allows for modification of the ball banking criteria. This serves to minimize future costs and alleviate exposure to dangerous conditions for field technicians who would have to re-evaluate the roadways using older ball bank methodologies.

Q Does the vehicle type matter?

- A** Not for the purpose of determining a safe curve speed. Mathematically the output is affected to a small degree by the height of the RDS7-GPS-PRO (high center of gravity vehicles exhibit the greatest variation). However, the effect on the final output is very small and offers no discernable difference in the safe curve speed report (The results between a full size pick-up truck and standard 4-door sedan yield the same recommended curve speed limit in side by side comparisons). (*Data Analysis, Installation & Setup, Data Collection*)

Q Can you use this for truck curve limits?

- A** Yes, the system allows the analyst to enter any custom lateral limit. For regulations that require a separate curve speed limit than passenger vehicles, such as commercial tractor trailers and trucks, the CARS solution allows the analyst to set any approved lateral limit for a custom report. (*Data Collection*)

Q Will it use metric units?

- A** Yes, the user can select either US Imperial units or International metric units and the selection is saved in the user's profile. (*Data Collection, Data Analysis*)

Q How do we provide training and support?

- A** Your certified CARS trained Service Provider provides in-service training as well as on-line webinars available depending on service solution. Technical support is available by phone and email - however most answers can be found



on the CARS portal - training materials and instructions for use are available on-line 24/7. (*Data Analysis, Installation & Setup, Data Collection*)

Q Can I use my existing RDS7-BB (any version: -C, -F, -N, -09)?

A No. The CARS solution includes the new RDS7-GPS-PRO. The GPS-PRO is built on the industry standard BB-09 platform but was redesigned with internal GPS integration and proprietary software. The RDS7-GPS-PRO is not a stand-alone device but a component of the entire CARS service solution.

Q How much faster and less expensive would you estimate the CARS method is over the traditional method?

A Using any of the existing ball bank methods (such as mechanical or digital ball bank indicators, accelerometers, inclinometers etc) horizontal curve speed studies can take anywhere from 1- 4 hours to survey a single curve, not including analyzing the data and producing the report (another 1-2 hours).

- The CARS service - depending on curve density on a corridor, drive, traffic etc - can collect minimally 40-60 CL miles of curve survey data in an 8 hour day. Then a CARS trained engineer analyst using the CARS online portal service could easily create up to 40 individual curve reports within 1-2 hours of work.
- For comparison, that equates to 10 curves per 1 hour versus 1 curve per 5 hours - that's a 50x savings in labor, which is where all the immediate cost savings comes from. Additionally there is more cost savings derived from the improved safety - ie, having a traffic engineer get injured or killed while ball banking can be expensive.
- And, more cost savings being able to better defend the results in court - ie, all the data tied back to calibrated equipment reduces the claims lost to individuals suing for badly signed curves where an injury or death occurred.

Q What about improperly placed horizontal curve speed advisory signs - can we leave them in place?

A The MUTCD 2009 *mandates* the **removal** of incorrect signs. The FHWA wants incorrectly low speed posted curve advisory signs removed, as they can cause driver confusion and complacency at the curves where the signs really do matter. See the MUTCD extract below: The underlined portion of the mandate indicates that the MUTCD is striving for consistency/uniformity across the US with regards to all traffic control devices. It requires that any traffic control devices/signs that are deemed unnecessary or inaccurate by current MUTCD based survey data should be removed in compliance with the mandate.

• Section 1A.04 Placement and Operation of Traffic Control Devices

1. *Placement of a traffic control device should be within the road user's*

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view so that adequate visibility is provided.

2. *To aid in conveying the proper meaning, the traffic control device should be appropriately positioned with respect to the location, object, or situation to which it applies.*
 3. *The location and legibility of the traffic control device should be such that a road user has adequate time to make the proper response in both day and night conditions.*
 4. *Traffic control devices should be placed and operated in a uniform and consistent manner.*
 5. *Unnecessary traffic control devices should be removed. The fact that a device is in good physical condition should not be a basis for deferring needed removal or change.*
- **Section 1A.06 Uniformity of Traffic Control Devices**
 1. *Support: Uniformity of devices simplifies the task of the road user because it aids in recognition and understanding, thereby reducing perception/reaction time.*
 2. *Uniformity assists road users, law enforcement officers, and traffic courts by giving everyone the same interpretation.*
 3. *Uniformity assists public highway officials through efficiency in manufacture, installation, maintenance, and administration.*
 4. *Uniformity means treating similar situations in a similar way. The use of uniform traffic control devices does not, in itself, constitute uniformity. A standard device used where it is not appropriate is as objectionable as a non-standard device; in fact, this might be worse, because such misuse might result in disrespect at those locations where the device is needed and appropriate.*

Q What projection does the GPS use for the Latitude and Longitude coordinates?

A WGS84



2 INSTALLATION & SETUP

Q What is required for installation? Do I need to modify the test vehicle?

- A** No addition equipment is needed and no vehicle modifications are required. The CARS components are non-permanent and easy to install, completely portable for multi-vehicle use. The RDS7-GPS-PRO installs exactly like the RDS7-BB-09, with Velcro (if Velcro does not stick, try wiping surface with alcohol swab prior). The tablet is securely held in place with either a cub holder or floor goose neck mount, which is supplied). Simple cable connections mate the RDS7-GPS-PRO and tablet. Nothing is permanently affixed to the vehicle.

Q What setup and zeroing is required?

- A** Zeroing (or leveling the device) is quick and easy. For this you simply need a level area (such as the tarmac at a gas station) to park the vehicle. With the RDS7-GPS-PRO and tablet installed, turn the unit on, and check the level via the LCD display of the RDS7-GPS-PRO for zero within 0.5°. The RDS7-GPS-PRO comes standard with the Relative Zero feature, which allows the operator to press a single button to set a new temporary zero - that's it. Ensure the tablet is receiving the GPS data and you are off and driving. (Note that if the Relative Zero (REL) is used, loss of power will return the unit to the factory calibrated zero. *(Data Collection)*)

Q Does it matter where in the vehicle the RDS7-GPS-PRO is mounted?

- A** The RDS7-GPS-PRO should be mounted in the center of the dash, LCD facing the rear of the vehicle. The CARS tablet should be mounted in either one of the mounting options (or equivalent) to secure it in place. *(Data Collection)*

Q How can I confirm that my tablet software is up to date?

- A** Any time the tablet is connected to the CARS server, the tablet will automatically check for updates and prompt the user to update to the latest version - which is fully automated. You can manually verify the tablet version from the Administration page of the tablet. *(Data Collection, Data Analysis)*

Q Is there a “read only” login?

- A** Yes, for customers with an Enterprise license, a management “read only” login is included. *(Data Analysis)*
- A** Also when the license expires, the user’s Rieker account remains active and allows the user access to all the data and reports on the portal



3 ON THE ROAD (DATA COLLECTION)

Q Is specialized training required?

- A** Yes, formal training is available and required to be authorized to use the service. The training class will cover the tips on how to ensure proper set up, proper driving and proper data analysis to ensure the results are accurate and conform to the MUTCD guidelines. For details on training availability and costs you can contact Rieker or your authorized CARS distributor. (*Data Analysis, Installation & Setup*)

Q What affect will driving too fast have on the results?

- A** Driving at or above the speed limit will have no effect on the device or the accuracy of the results. However, it is difficult to drive smoothly and remain in the center of the lane. Any erratic driving, which is typical of driving the corner at higher speed, will lower the Calculated Advisory speed and may cause the Recommended Advisory Speed to be 5 mph (10 kmh), or more, lower than it would be if the driving was done more smoothly. Erratic driving can also account for inconsistent results between passes.

Q Are there limits to the amount of data recorded to the tablet?

- A** Not realistically. The tablet is capable of storing more than 10,000 hours of data collection between up loads to the portal.

Q Why don't you have to go the speed limit?

- A** You can travel at any speed because the CARS Solution integrates GPS and Ball Bank accelerations continuously.- no longer limited by driving the posted speed limit, so driving with traffic is no longer a hindrance.

Q Why is slower better?

- A** Slower is better. To achieve best results, a slow smooth speed allows the system to record a higher number of data points. It allows the driver to steer smoother, following the center of the driving lane, which is proven to provide the best data for curve analysis driving slower is safer since it allows driving in traffic and other conditions.

Q Is it better to record the driving survey data in one continuous file?

- A** For file size and ease of uploading - best practice is to limit each data session to 20-30 minutes. Typically a corridor should be segmented into 4 data sessions - 1 each for each direction of travel (2 passes in each direction). (*Data Analysis*)

Q How many passes are required?

- A** One pass in each direction is sufficient, however, best practices recommend two passes in each direction.

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Q Does driving skill matter?

A Yes, driver skill makes the most difference in proper data collection efforts. The training provided addresses this issue and a certificate would be presented upon successful completion of the CARS training course. Smooth driving, staying in the center of the driving lane will provide the best and most consistent results. Slower speeds will produce better results because of steady driving. Over- and under-steering, sharp acceleration/deceleration will influence the results. Poor driving equals higher lateral acceleration, which equals lower safe curve speed limits not necessarily accurate or appropriate for the road. Smooth slower driving equals appropriate, more accurate recommended safe curve speed limits.

Q Will it work without GPS?

A Yes, the CARS solution provides for loss of GPS via “Non GPS Mode”.

Q What is “Non GPS Mode”?

A “Non GPS Mode” allows a driver to analyze a curve with no GPS reception. In this mode, the driver is required to make at least two passes in each direction, and conduct the test pass at different speeds (at least 10 MPH from one another). So, like the traditional method, the driver will have to turn around to analyze each curve. Also, the user will have to enter the test speed, since there is no GPS to provide test speed and the driver will have to hold that speed constant. The system will use this data to determine the safe curve speed, which is still customizable as it is in the normal mode, however, the user will not get a map of the curve and no Radius or super-e can be reported from this data. For convenience, it is recommended to attempt the route another day however, since it may be a simple satellite reception issue that should rectify itself at another. (*Data Analysis*)

Q How much territory can I cover?

A This is highly dependent on the driver and road conditions. However, for planning purposes a properly trained driver may drive 40-60 miles (100 km) - which includes two passes in each direction - in a normal work day.

Q Will it work on gravel roads?

A Yes, as long as the tires are not slipping the CARS solution will provide the precision data needed for generating safe curve speed reports. Slowing down the vehicle’s speed is highly recommended.

Q Will it work on wet, snow covered roads?

A Yes, same as gravel roads, as long as the vehicle is not slipping or fishtailing - use caution and best judgment if attempting to survey roads during adverse conditions. Slowing down the vehicle’s speed or waiting for until the road to clear is highly recommended.



Q Will is work on “S” turns or reverse curves?

A Yes, the CARS solution is designed to allow the operator to just drive along a route, the data collected accounts for multiple curves in a row. The analyst, however, will have to break up the “S” curve, or any curve with multiple changes in direction, into two or more simple curves that contains one direction change.

Q Can off-ramps be analyzed using the cars analysis software?

A Yes. Like S-turns or reverse curves, the system will analyze one curve at a time, and is limited to a deflection angle of less than 180 degrees for any given curve using the standard parabolic model. The system does allow the analyst to use a circular model for circular ramps that exceed 180 degrees of deflection (realistically anything over 140 degrees should either be broken into multiple curves or use the circular model if appropriate. If a ramp is not circular, but exceeds 140 degrees, , the curve should be broken into multiple curves. (*Data Analysis*)

Q During yearly maintenance activities certain roads received a chip seal. This makes the surface lateral friction factor something other than the pavement friction factor in degrees provided by the curve reports. Do you have any accommodation for such a surface? Has any of your other clients expressed concerns with the surface type?

A Yes.. Different surface treatments will change the surface friction and therefore the lateral force at which a tire will slip. The Ball Banking process, regardless of the technology used, is based on the tires NOT slipping or skidding, and the maximum lateral forces established by the MUTCD Regulations are designed to prevent lateral slip/skid at a particular speed.

For example 12 degrees will not produce a skid for a particular turn at a specified speed. Improving the surface treatment may allow for a higher lateral value, say 14 or 16, where the tires won’t skid at that speed, but there would not be a regulation to support that. Similarly, if a road surface is treated with a material that reduces the friction of the surface, you may need a lower max lateral value to preserve the tires from skidding.

The advantage to the CARS solution is that the survey doesn’t need to be re-done. The analyst can change the values used to meet any Regulation or desired side friction limit, but it would be up to the analyst to make sure the approved values are used if you change it from the MUTCD recommended values.

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4 AT YOUR DESK (DATA ANALYSIS)

Q Can you give me a step by step Portal analysis walkthrough?

A First step to access the portal is to enter your selected username and password on riekersolutions.com. Once granted access, scroll your mouse over the “my solutions” drop down bar next selecting the CARS option. A tabs window should appear with the data sessions tab being the first already selected option showing various runs that have been uploaded.

Next, you can scroll or search for the specific run you want to analyze, once found, select the curve then clicking the “curves tab”. Find the first designated curve on the selected data session you want to analyze by scrolling and zooming on the map towards the red and yellow spots located along curved parts of the road. When you have found your first curve click and place your PT & PC drop pins on either side of the curve, which should cast a net. Ensure that the designated fit percentage is 98-99 percent for best data output.

Next, name and save the curve which then will give you the option to “view report” or “edit”. Clicking the view report button will bring you to the page of where all your calculated data, raw data, and graphs are located which can be exported to a CSV or viewed as a PDF allowing for a savable or printable version of the report. (*Data Analysis, Installation & Setup*)

Q I’m having trouble uploading data files what should I do?

A There are additional troubleshooting tools available under the Administration tab on the tablet. Confirm the server address is: riekersolutions.com. Ensure that your login ID and password are validated next clicking ok.

Q Why are certain curves that are not highlighted red showing a higher advisory speed limit than the posted speed limit?

A This is common and not a problem. The yellow and red shading indicate “areas of interest” due to high accelerations. However, you can perform the analysis on an area where the calculated advisory speed is at or above the posted speed limit. The reports will list this condition on the report. There is no need for an advisory sign in this area, but you may want to keep the report as a future reference.

Q Why would it give different speeds over different tests?

A The reporting system calculates the exact speed that will produce the desired lateral (side) force. These values will vary slightly between test runs and can be reviewed in the report. The values are then rounded down to the next lower 5 MPH (or 10 KMH) for purposes of signing. So, if one calculated value is just over an even 5 value, then the next value might be rounded down almost 5 MPH (or 10 KMH).



Q How long does it take to analyze a curve?

A This is dependent on the analyst. However for planning purposes a properly trained analyst may generate 20-30 curve reports in an hour.

Q While analyzing a data session in the CARS online portal what is the significance of the color scales that show up on the map? What does the green to red color scale indicate when shown on a map of a road that has been surveyed?

A There is a specific color conventions used within the portal, which are as follows:

- **Data Sessions** - are painted on the Google Map, typically in GREEN. For areas that have a higher lateral acceleration relative to the test velocity (f/V), the Green begins to shade progressively to YELLOW and untimely RED for the highest (f/V). This shading is intended to be a visual queue for “Areas of Interest”. That is they are “likely” to be areas of a curve or curve that should be evaluated. These colors have no impact on the curve analysis itself.
- **Curves** - are typically colored in BLUE, however, curves with a low fit, ie, less than 90% are shaded in red. This is intended to provide a visual queue to revisit the data in the analysis as the results may not be reliable with such a low fit. Note: You can generally improve the fit by reducing the data points in the net, but this can lead to problems, as too few data points will not provide accurate results. Your goal is generally to include as many data points as possible to the tangent, until the model, or fit, starts to break down.

Q Why does a narrower net improve the fit?

A The software fits the data points to a parabola, so few data points can provide a better fit, but not necessarily a better analysis. The analyst should use as many points as possible before the model significantly breaks down.

Q Do the red spots on a curve explicitly represent a ‘problem areas’ where the data collected is sub-par?

A No. The yellow and red areas are indications of a relatively high (f/V) ratio, which is expected at a curve and therefore a good place to consider doing a curve analysis.

Q Is it possible to add a new pass from a new Data Session to an existing curve?

A Yes. The procedure is to select a curve on the Curves tab, switch to the Data Sessions tab, select the extra data session you want added, return to the Curves tab, click "edit", and move one of the PC or PT markers slightly, the extra data session will be added to the curve. Click Save.



- Q Is it possible to have multiple curve reports for the same data session? Why would this be desirable?**
- A Yes, you can copy curves to create multiple curves from the same data. This is typically done to show the advisory speeds for different lateral limits. For example 12 degrees for cars, and 10 degrees for trucks, may yield different speeds.**
- Q What data is supplied on the reports?**
- A The portal and printed reports provide all the information associated to the safe curve speed assessment. Additionally, the reports provide the curve Radius, cross slope (super-elevation), test speed, Latitude and Longitude coordinates of the PC and PT and the curve length and deflection angle, and vertical curve grade.**
- Q Can I get, download and keep all the data?**
- A Yes, the all the data is downloadable in a .CSV file format via the portal. You can download all your collected test data and all the processed report data**
- Q Do I need the portal after I return the unit?**
- A No. You only will need ongoing portal access if you want to generate reports from your data, which is stored on the CARS password protected server. Since all the data can be downloaded at any time, you can calculate the speed from the provided data.**
- Q Why is it important to resign my curves when in the past these were signed at 10 degrees? It seems that it would make it safer by posting a lower advisory speed.**
- A Improperly low signs are required to be removed. Car stability and technology has vastly improved over the past decades since the 10 degrees was the established protocol and FHWA through the MUTCD further defined the ranges more appropriate to modern standards (12, 14, 16 respectively). Low speed signs perpetuate a pattern of non-compliance and therefore pose a safety risk at properly signed curves.**
- Q Why does my data not follow the Google Maps roadways exactly?**
- A The Google Maps roadways are a less accurate projection of where the road actually is. Your data has more exact latitude and longitude coordinates associated with it and is put over top the Google Maps roadway image for reference.**



5 PURCHASING

Q Can I buy or rent CARS? Are there any limits on the use?

- A** CARS is a service solution and is distributed through Authorized Service Providers in your state. Please contact Rieker, we will be happy to discuss which option fits your Federal, State, District, County, Township, Municipality, or Public Works needs / goals and provide the best recommendation.

Now available through authorized fully trained and certified service providers - complete turnkey State-wide enterprise to project based solutions. Call us today to find the service provider in your state and learn how Rieker CARS™ Solution will help you meet the FHWA mandate for re-surveying all required roadway horizontal curves by 2019.

The Curve Advisory Reporting Service (CARS™) for:

- Meeting FHWA 2009 MUTCD requirements by 2019, including:
 - Correct Horizontal Curve Alignment Signage
 - Identifying and Removing incorrectly placed or unnecessary signage
 - Chevron placement and spacing
- Safely Driving with traffic - one pass - any speed
- Automatically calculates safe curve speed, for accuracy and uniformity
- Short-term or Long-term road survey projects

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Find out more www.riekerinc.com/CurveAdvisoryReporting.htm