

RoadBC Version 4.10
Manual BackCalculation Spreadsheet
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[GENERAL HELP](#)

[TRIAL DATA Sheet](#)

[FWD DATA Sheet \(and Chart\)](#)

[to Trial Data Sheet](#)

[to FWD Data Sheet](#)

GENERAL HELP

[Back to top](#)

RoadBC is an Excel@ spreadsheet that helps teach backcalculation of Falling Weight Deflectometer (FWD) data. It uses input data to create, call, and retrieve the results from CHEVLAY2. It shows the results graphically and provides a historical record of a given trial. It has 10 trial data sets to help illustrate various issues associated with backcalculation. It can also be used to analyze any set of deflection data.

CHEVLAY2 is Fortran code that provides stresses, strains, and deflections due to a force applied on a circular plate on a layered system. For more details please read the **Chevlay2.doc** file provided with CHEVLAY2.

RoadBC is primarily a teaching tool but also can be used to analyze difficult deflection basins. It is assumed the user of RoadBC understands the use of FWD data and the basic reasons for backcalculation.

RoadBC has been tested with Excell@2003 in the USA. No other versions of Excel@ are guaranteed to work. Please email me if you are unable to run the macros in the spreadsheet and would like help.

This help, and notes on each sheet, explain how to use the spreadsheet and macros. As received, RoadBC shows the user 3 sheets and one chart in a file named RoadBC Version 4.10. The user may change the name of the file at anytime.

Please use the comment triangles on many of the cells in the spreadsheet to get the details for that cell. To activate, be sure comments are shown (use Tools, Options to activate.)

[TRIAL DATA Sheet](#)

[Back to top](#)

This sheet contains 10 sample problems designed to help understand the problems in backcalculation of FWD data. A **COPY TrialData** macro has been provided to make it easy to copy the data from the trials into the proper places in the FWD Data sheet.

A person new to backcalculation may want to start with the first trial and work down to trial 10. All of the trials are simulated deflection basins created using CHEVLAY2. The correct answers are on a hidden page named *Results*. To view, click on the Stop Sign icon and enter the password. To obtain the password, contact David Orr at the email on the top of the page. **AHint** button is provided on the FWD Data sheet to provide some help.

To activate the **COPY** macro, type in the number of the trial to be used and start the macro. This can be done by:

clicking on the lightning bolt

typing ctrl+t

running the **TrialData** macro from the Macro menu under Tools

running the **C**opy **T**rial macro using the command in main toolbar under Road BC

The **COPY** macro will copy the provided data and reset the FWD Trial sheet to the seed condition. (IMPORTANT: This cannot be undone once activated. Please save the results of a previous trial in a spreadsheet with a different name if you want to keep the trial data.)

This sheet is where the manual backcalculation is performed. The colored cells show where data need to be provided.

To use the program for evaluation of deflection basins that are not part of the trial data sets, replace the data in the colored cells with the information from the FWD and the proposed pavement model.

After each run of CHEVLAY2, there is a set of post-processed data showing the errors for each run. Unless reset, each run is saved to provide a historical record of the estimates of layer moduli. The chart shows the results of the current iteration graphically. A hyperlink to a larger version of the chart allows closer inspection.

To run a test, activate the **GO** macro. This can be done by:

- clicking on the Go button
- typing ctrl+g
- running the **ChevlayRun** macro from the Macro menu under Tools
- running the **Go CHEVLAY2** macro using the command in main toolbar under Road BC

To Reset the page to the seed condition, activate the **RESET** macro. This can be done by:

- clicking on the stop sign
- typing ctrl+r
- running the **ResetChevy** macro from the Macro menu under Tools
- running the **Reset Page** macro using the command in main toolbar under Road BC

RESET TRIAL clears all of the historical data and removes the seed moduli. Please save the spreadsheet with a new name if you wish to save the results for later inspection.

To clear the page of all data, activate the **Clear All Data** macro. This macro will remove all of the FWD and pavement model data in anticipation of using *RoadBC* to analyze a new deflection basin and pavement model.

To change the location of the subgrade strain, click on the purple check button associated with the first subgrade layer. Subsequent calculations of the subgrade strain will be made at the interface of the checked layer and the layer above.

The *chart* can be seen in a full screen by clicking anywhere on the chart. This activates the Chart Sheet. To return to the FWD Data page from the *chart*, click on the banner near the bottom right of the screen.

For more details on how to perform backcalculation, please see other documentation such as *an instructional Guide for BackCalculation and the Use of MODCOMP3* (Cornell Local Roads Program, Ithaca, NY 14853).

Fill out each of the colored blocks with data

Starts the RoadBC macro

Problem Title: 1 - Exact Deflections - 3 layer system

Location of CHEVLA2: []

FWD Data (fill out any 2 of 3)

Force applied: 0 pounds
 Pressure applied: 85.0 psi
 Radius of FWD plate: 5.91 inches

Deflectometer Data

of Deflectometers: 9

Radius (inches)	0.0	8.0	12.0	18.0	24.0	36.0	48.0	60.0	72.0
Deflection (mils)	19.76	15.80	13.60	11.08	9.26	6.87	5.37	4.34	3.60

Layer Data

Number of Layers (maximum of 6): 3

Layer	Modulus (psi)	Poisson's ratio	Thickness (inches)
Subgrade	100,000	0.35	6.0
Layer 1	60,000	0.40	18.0
Layer 2	5,000	0.42	0.0
Layer 3 (Subgrade)			
Layer 4			
Layer 5			
Layer 6			

Lowest thickness assumed to be infinity

Radius (inches)

Deflections (mils)	0.0	8.0	12.0	18.0	24.0	36.0	48.0	60.0	72.0
Actual	19.76	15.80	13.60	11.08	9.26	6.87	5.37	4.34	3.60
Calculated	27.11	20.63	18.39	16.37	14.88	12.47	10.51	8.89	7.57
Absolute Difference	7.35	4.83	4.79	5.29	5.62	5.60	5.14	4.55	3.97
Percent Difference	37.20%	30.57%	35.22%	47.74%	60.69%	81.51%	95.72%	104.84%	110.28%

Iteration Number: 1

RMS Error: 73.4%

Surface Lifespans: 8.72
 Subgrade Lifespans: 4.90

millions of ESALs

Critical Strains

Iteration	Moduli Layer 1	Moduli Layer 2	Moduli Layer 3	Moduli Layer 4	Moduli Layer 5	Moduli Layer 6	RMS Error	Surface	Subgrade	Lifespan
2	100,000	60,000	5,000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1	100,000	60,000	5,000	#N/A	#N/A	#N/A	73.4%	229.66	-398.04	4.90

Graph showing deflection basins and % error

Click on the chart to see an expanded view.

Be sure to include moduli

Resets the page for a new problem

Graph showing deflection basins and % error

Calculated data and stored iterations