Spreadsheet Title:	Load Combinations, ver. 0.66 (© DesignSpreadsheets.com 2005-2008)
Last Revision Date:	11/16/2005

All blue fields are used for input.

by DesignSpreadsheets.com
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Project	Demo of Load Combinations Spreadsheet for DesignSpreadsheets.com webpage.
Job No.	xy
Subject	This spreadsheet demonstrates how to efficiently assemble AASHTO LRFD load combinations.
Sheet No.	xy
Made By	admin
Date Made	12/30/2005
Checked By	admin
Date Checked	12/30/2005

Comments

12/30/2005	Created by BridgeArt.net.

Spreadsheet Instructions

Macros must be enabled to obtain full functionality of this spreadsheet.

This spreadsheet is an efficient tool to assemble load combinations from indiviual load cases. It utilizes three Visual Basic functions (getTableValue, getTrX, getTrY) to retrieve specified value from a table and to perform coordinate transformation. These functions are described in more detail below.

The spreadsheet has enough flexibility to easily add new load cases, load labels, and load combinations.

User must hit the "Recalculate" button on the "LRFD" tab to update all load combinations prior to exporting or printing data from this spreadsheet. Otherwise incorrect data might be exported or printed. This button recalculates the whole spreadsheet.

Color coding

[CYAN shading]	User's input.
[LIGHT GREEN shading]	Cell whose content was copied to adjacent cells AS FORMULA.

Adding New Load Case

To create new load case, or to add load case into a load combination, simply create copy of a row with existing load case using the following procedure:

1. Right-click heading of a row with existing load case and select "Copy" from the pop-up menu.

2. Select a row above which you want to insert new load case, right-click ans select "Insert Copied Cells" from the pop-up menu.

3. Change the load case name and load factors as needed.

Adding New Load Label

To create new load label, create copy of a column with existing load label using the following procedure:

1. Right-click heading of a column with existing load label and select "Copy" from the pop-up menu.

2. Select a column before which you want to insert new load label, right-click and select "Insert Copied Cells" from the pop-up menu.

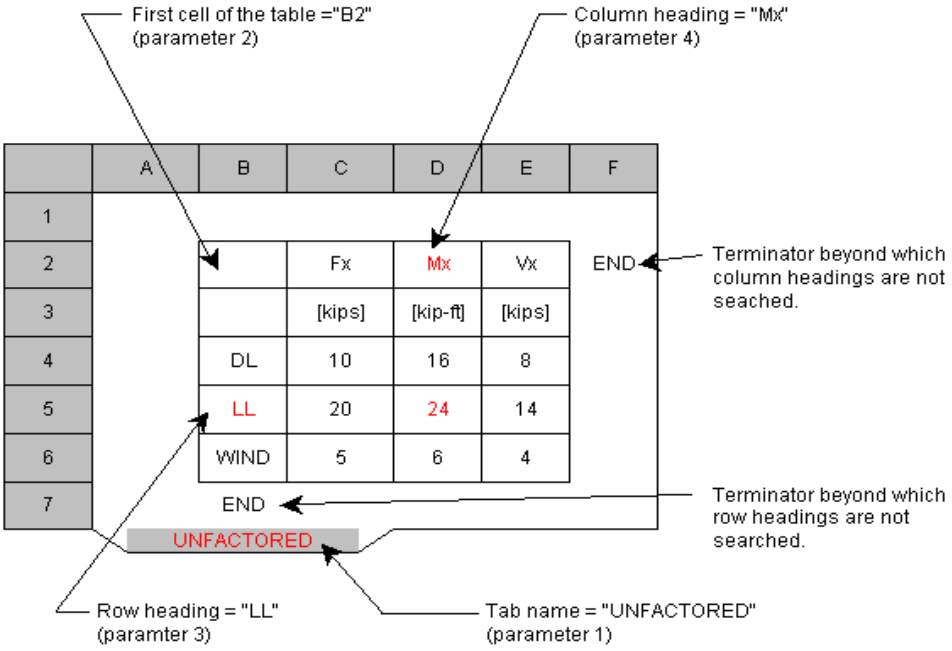
3. Change the load label name as needed.

Function getTableValue( )

The user-defined function getTableValue(sheet, tableLeftTopCell, rowHeading, columnHeading) takes four parameters and is used to retrieve a data from a table. The meaning of the four parameters is described below:

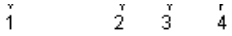
sheet	Name of tab with table. Used to locate the table.
tableLeftTopCell	Address of the cell in a upper left corner of the table. Used to locate the table.
rowHeading	Defines table row from which the value is requested.
columnHeading	Defines table column from which the value is requested.

The function returns a value at the intersection of specified row and column headings. The function browses through row headings from top to bottom until it reaches a desired heading or a cell containing "END" string. Similar procedure is used for column headings. In the specified heading is not found, ie. the cell with "END" string is reached, "***ERROR***" value is returned.



Formula =getTableValue("UNFACTORED", "B2", "LL", "Mx") will return value 24.

1 2 3 4



Illustrative Figure

Functions getTrX( ) and getTrY( )

The user-defined functions getTrX(x, y, theta) and getTrY(x, y, theta) take three parameters and are used to perform transformation into a rotated coordinate system. The meaning of the thee parameters is described below:

x	original "unrotated" x value
y	original "unrotated" y value
theta	angle of coordinate system rotation [deg]

The functions treats nonnumerical parameters as zeros and returns '-' value for zero output.

Disclaimer

This spreadsheet was created in the hope that it will be useful, but is distributed without any warranty from the author.

Spreadsheet Revision History

11/16/2005 [ver. 0.65]	First BridgeArt.net version.
12/30/2005 [ver. 0.66]	Improved documentation and disabled printing and saving for demo version.

Registration

Unregistered Demo Version

Registration Key ???

DESIGNSPREADSHEETS.COM

Load Combinations, ver. 0.66
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Project: ***Demo of Load Combinations Spreadsheet for DesignSpreadsheets.com webpage.***	Made By: *admin* Date: *12/30/2005*	Job No: *xy*
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	Unfactored Forces						Transformed Unfactored Forces						
	Z	X	Y	@ Z	@ X	@ Y	z'	x'	y'	@ z'	@ x'	@ y'	
Load Case	*VERT* [kips]	*LONG* [kips]	*TRANS* [kips]	*MOM@V* [kip-ft]	*MOM@L* [kip-ft]	*MOM@T* [kip-ft]	*VERT* $_{TR}$ [kips]	*LONG* $_{TR}$ [kips]	*TRANS* $_{TR}$ [kips]	*MOM@V* $_{TR}$ [kip-ft]	*MOM@L* $_{TR}$ [kip-ft]	*MOM@T* $_{TR}$ [kip-ft]	*Theta* [deg]
DC	12.0	-	-	-	-	-	12.0	-	-	-	-	-	20.00
DW	29.8	-	-	-	-	-	29.8	-	-	-	-	-	20.00
LL max	280.2	-	-	-	-	-	280.2	-	-	-	-	-	20.00
LL min	-	-	-	-	-	-	-	-	-	-	-	-	20.00
LL permit	342.6	-	-	-	-	-	342.6	-	-	-	-	-	20.00
BR	-	18.0	-	-	-	522.4	-	16.9	-6.2	-	178.7	490.9	20.00
CE	-	-	-	-	-	-	-	-	-	-	-	-	20.00
TU	-	61.0	-	-	-	1154.1	-	57.3	-20.9	-	394.7	1084.5	20.00
WS longit	-	19.3	-	-	-	416.6	-	18.1	-6.6	-	142.5	391.5	20.00
WL longit	-	-	-	-	-	-	-	-	-	-	-	-	20.00
WS transv	-	-	22.3	-	448.2	-	-	7.6	20.9	-	421.1	-153.3	20.00
WL transv	-	-	5.2	-	149.8	-	-	1.8	4.9	-	140.8	-51.2	20.00
EQ1	-	-	-	-	-	-	-	-	-	-	-	-	20.00
EQ2	-	-	-	-	-	-	-	-	-	-	-	-	20.00
EQ3	-	-	-	-	-	-	-	-	-	-	-	-	20.00
							0.0	-	-	0.0	-	-	20.00
							0.0	-	-	0.0	-	-	20.00

Load Modifiers for Strength Limits States [AASHTO-LRDF 1.3.2, p. 1-3]

η_d =	1.00	ductility factor
η_r =	1.05	redundancy factor
η_i =	1.05	operational importance factor

Note: for all limit states other than the strength limit states, the load modifiers are equal to 1.00

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γ	η_d	η_r	η_i	other	Total Load Multiplier	Load Combination	Load Cases	z' VERT $_{TR}$ [kips]	x' LONG $_{TR}$ [kips]	y' TRANS $_{TR}$ [kips]	@ z' MOM@V $_{TR}$ [kip-ft]	@ x' MOM@L $_{TR}$ [kip-ft]	@ y' MOM@T $_{TR}$ [kip-ft]
						UNFACTORED LOADS	DC	12.0	-	-	-	-	-
							DW	29.8	-	-	-	-	-
							LL max	280.2	-	-	-	-	-
							LL min	-	-	-	-	-	-
							LL permit	342.6	-	-	-	-	-
							BR	-	16.9	-6.2	-	178.7	490.9
							CE	-	-	-	-	-	-
							TU	-	57.3	-20.9	-	394.7	1084.5
							WS longit	-	18.1	-6.6	-	142.5	391.5
							WL longit	-	-	-	-	-	-
							WS transv	-	7.6	20.9	-	421.1	-153.3
							WL transv	-	1.8	4.9	-	140.8	-51.2
							EQ1	-	-	-	-	-	-
							EQ2	-	-	-	-	-	-
							EQ3	-	-	-	-	-	-
1.25	1	1.05	1.05	1	1.378	**STRENGTH I**	DC	16.5	0.0	0.0	0.0	0.0	0.0
1.5	1	1.05	1.05	1	1.654		DW	49.3	0.0	0.0	0.0	0.0	0.0
1.75	1	1.05	1.05	1	1.929		LL max	540.6	0.0	0.0	0.0	0.0	0.0
1.75	1	1.05	1.05	1	1.929		BR	0.0	32.6	-11.9	0.0	344.7	947.0
0.5	1	1.05	1.05	1	0.551		TU	0.0	31.6	-11.5	0.0	217.6	597.8
							Total Strength I	**606.5**	**64.2**	**-23.4**	**0.0**	**562.3**	**1544.9**
1.25	1	1.05	1.05	1	1.378	**STRENGTH II**	DC	16.5	0.0	0.0	0.0	0.0	0.0
1.5	1	1.05	1.05	1	1.654		DW	49.3	0.0	0.0	0.0	0.0	0.0
1.35	1	1.05	1.05	1	1.488		LL permit	509.9	0.0	0.0	0.0	0.0	0.0
1.35	1	1.05	1.05	1	1.488		BR	0.0	25.2	-9.2	0.0	265.9	730.6
0.5	1	1.05	1.05	1	0.551		TU	0.0	31.6	-11.5	0.0	217.6	597.8
							Total Strength II	**575.8**	**56.8**	**-20.7**	**0.0**	**483.5**	**1328.4**
1.25	1	1.05	1.05	1	1.378	**STRENGTH IIIa**	DC	16.5	0.0	0.0	0.0	0.0	0.0
1.5	1	1.05	1.05	1	1.654		DW	49.3	0.0	0.0	0.0	0.0	0.0
1.4	1	1.05	1.05	1	1.544		WS longit	0.0	27.9	-10.2	0.0	219.9	604.2
0.5	1	1.05	1.05	1	0.551		TU	0.0	31.6	-11.5	0.0	217.6	597.8
							Total Strength IIIa	**65.9**	**59.5**	**-21.7**	**0.0**	**437.5**	**1202.1**
1.25	1	1.05	1.05	1	1.378	**STRENGTH IIIb**	DC	16.5	0.0	0.0	0.0	0.0	0.0
1.5	1	1.05	1.05	1	1.654		DW	49.3	0.0	0.0	0.0	0.0	0.0
1.4	1	1.05	1.05	1	1.544		WS transv	0.0	11.8	32.3	0.0	650.0	-236.6
0.5	1	1.05	1.05	1	0.551		TU	0.0	31.6	-11.5	0.0	217.6	597.8
							Total Strength IIIb	**65.9**	**43.4**	**20.8**	**0.0**	**867.6**	**361.3**
1.25	1	1.05	1.05	1	1.378	**STRENGTH Va**	DC	16.5	0.0	0.0	0.0	0.0	0.0
1.5	1	1.05	1.05	1	1.654		DW	49.3	0.0	0.0	0.0	0.0	0.0
1.35	1	1.05	1.05	1	1.488		LL max	417.0	0.0	0.0	0.0	0.0	0.0
1.35	1	1.05	1.05	1	1.488		BR	0.0	25.2	-9.2	0.0	265.9	730.6
0.4	1	1.05	1.05	1	0.441		WS longit	0.0	8.0	-2.9	0.0	62.8	172.6
1	1	1.05	1.05	1	1.103		WL longit	0.0	0.0	0.0	0.0	0.0	0.0
0.5	1	1.05	1.05	1	0.551		TU	0.0	31.6	-11.5	0.0	217.6	597.8
							Total Strength Va	**482.9**	**64.8**	**-23.6**	**0.0**	**546.3**	**1501.1**
1.25	1	1.05	1.05	1	1.378	**STRENGTH Vb**	DC	16.5	0.0	0.0	0.0	0.0	0.0
1.5	1	1.05	1.05	1	1.654		DW	49.3	0.0	0.0	0.0	0.0	0.0
1.35	1	1.05	1.05	1	1.488		LL max	417.0	0.0	0.0	0.0	0.0	0.0
1.35	1	1.05	1.05	1	1.488		BR	0.0	25.2	-9.2	0.0	265.9	730.6
0.4	1	1.05	1.05	1	0.441		WS transv	0.0	3.4	9.2	0.0	185.7	-67.6
1	1	1.05	1.05	1	1.103		WL transv	0.0	2.0	5.4	0.0	155.2	-56.5
0.5	1	1.05	1.05	1	0.551		TU	0.0	31.6	-11.5	0.0	217.6	597.8
							Total Strength Vb	**482.9**	**62.1**	**-6.1**	**0.0**	**824.4**	**1204.3**

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γ	η_d	η_r	η_i	other	Total Load Multiplier	Load Combination	Load Cases	z' $VERT_{TR}$ [kips]	x' $LONG_{TR}$ [kips]	y' $TRANS_{TR}$ [kips]	@ z' $MOM@V_{TR}$ [kip-ft]	@ x' $MOM@L_{TR}$ [kip-ft]	@ y' $MOM@T_{TR}$ [kip-ft]
1.25	1	1	1	1	1.250	**EXTREME Ia**	DC	15.0	0.0	0.0	0.0	0.0	0.0
1.5	1	1	1	1	1.500		DW	44.8	0.0	0.0	0.0	0.0	0.0
0.5	1	1	1	1	0.500		LL max	140.1	0.0	0.0	0.0	0.0	0.0
0.5	1	1	1	1	0.500		BR	0.0	8.5	-3.1	0.0	89.3	245.4
1	1	1	1	1	1.000		EQ1	0.0	0.0	0.0	0.0	0.0	0.0
							Total Extreme Ia	**199.9**	**8.5**	**-3.1**	**0.0**	**89.3**	**245.4**
1.25	1	1	1	1	1.250	**EXTREME Ib**	DC	15.0	0.0	0.0	0.0	0.0	0.0
1.5	1	1	1	1	1.500		DW	44.8	0.0	0.0	0.0	0.0	0.0
0.5	1	1	1	1	0.500		LL max	140.1	0.0	0.0	0.0	0.0	0.0
0.5	1	1	1	1	0.500		BR	0.0	8.5	-3.1	0.0	89.3	245.4
1	1	1	1	1	1.000		EQ2	0.0	0.0	0.0	0.0	0.0	0.0
							Total Extreme Ib	**199.9**	**8.5**	**-3.1**	**0.0**	**89.3**	**245.4**
1.25	1	1	1	1	1.250	**EXTREME Ic**	DC	15.0	0.0	0.0	0.0	0.0	0.0
1.5	1	1	1	1	1.500		DW	44.8	0.0	0.0	0.0	0.0	0.0
0.5	1	1	1	1	0.500		LL max	140.1	0.0	0.0	0.0	0.0	0.0
0.5	1	1	1	1	0.500		BR	0.0	8.5	-3.1	0.0	89.3	245.4
1	1	1	1	1	1.000		EQ3	0.0	0.0	0.0	0.0	0.0	0.0
							Total Extreme Ic	**199.9**	**8.5**	**-3.1**	**0.0**	**89.3**	**245.4**
1	1	1	1	1	1.000	**SERVICE I**	DC	12.0	0.0	0.0	0.0	0.0	0.0
1	1	1	1	1	1.000		DW	29.8	0.0	0.0	0.0	0.0	0.0
1	1	1	1	1	1.000		LL max	280.2	0.0	0.0	0.0	0.0	0.0
1	1	1	1	1	1.000		BR	0.0	16.9	-6.2	0.0	178.7	490.9
0.3	1	1	1	1	0.300		WS longit	0.0	5.4	-2.0	0.0	42.7	117.4
1	1	1	1	1	1.000		WL longit	0.0	0.0	0.0	0.0	0.0	0.0
1	1	1	1	1	1.000		TU	0.0	57.3	-20.9	0.0	394.7	1084.5
							Total Service I	**322.0**	**79.7**	**-29.0**	**0.0**	**616.1**	**1692.8**

SUMMARY	Strength I	606.5	64.2	-23.4	-	562.3	1544.9
	Strength II	575.8	56.8	-20.7	-	483.5	1328.4
	Strength IIIa	65.9	59.5	-21.7	-	437.5	1202.1
	Strength IIIb	65.9	43.4	20.8	-	867.6	361.3
	Strength Va	482.9	64.8	-23.6	-	546.3	1501.1
	Strength Vb	482.9	62.1	-6.1	-	824.4	1204.3
	Extreme Ia	199.9	8.5	-3.1	-	89.3	245.4
	Extreme Ib	199.9	8.5	-3.1	-	89.3	245.4
	Extreme Ic	199.9	8.5	-3.1	-	89.3	245.4
	Service I	322.0	79.7	-29.0	-	616.1	1692.8