TURN.LSP Turn Radius Instructions for Use with Imperial Unit AASHTO Vehicle Blocks

LICENSE

These instructions, the Imperial Unit AASHTO vehicle blocks and the working version of Turn.lsp are located at the AutoCAD Wiki: http://autocad.wikia.com/wiki/Turning_path_tracker_%28AutoLISP_application%29

These instructions are only for use with the Imperial Unit AASHTO vehicle blocks provided at the AutoCAD Wiki. The vehicle blocks and these instructions were both created to ensure proper modeling given the parameters of the lisp routine and vehicle turn radius parameters as shown in AASHTO's Green Book. It is important to note that Turn.lsp is encoded to model turn radius paths given that vehicles steer on the centroids of the wheels, not the rims. However, AASHTO's Green Book shows minimum turning radii as tracking along the path of the outermost edge (the rim) of the left front wheel. The vehicle blocks were created to reconcile this discrepancy such that the paths generated by Turn.lsp are in agreement with AASHTO's Green Book.

OVERVIEW

To model AASHTO Vehicle turn radius paths, all Turn.lsp needs from you is a polyline representing the desired path of the left front wheel and one of the Imperial Unit AASHTO Vehicle blocks provided at the AutoCAD Wiki. The AASHTO Vehicle block library consists of all of the AASHTO vehicles that have up to one trailer. (Note that Turn.lsp currently only supports modeling of vehicles with either no trailer or one trailer.) Turn.lsp will draw all other tire paths, the hitch path (if applicable) and places multiple instances of the vehicle being modeled along the paths.

INSTRUCTIONS

1) Appload the Turn.lsp routine into your drawing. The routine will automatically generate the following new layers which it will use for modeling:

LAYER	COLOR	LINETYPE	DESCRIPTION
C-TURN-HTCH-PATH	green	Continuous	Hitch Path
C-TURN-TRAL-BODY	yellow	Continuous	Trailer Body
C-TURN-TRAL-RLTR-PATH	cyan	Dashed	Trailer Rear Left Tire Path
C-TURN-TRAL-RRTR-PATH	cyan	Dashed	Trailer Rear Right Tire Path
C-TURN-TRCK-BODY	red	Continuous	Truck Body
C-TURN-TRCK-FRTR-PATH	green	Dashed	Truck Front Right Tire Path
C-TURN-TRCK-RLTR-PATH	green	Dashed	Truck Rear Left Tire Path
C-TURN-TRCK-RRTR-PATH	green	Dashed	Truck Rear Right Tire Path

NOTE: The layer Descriptions as shown in the above Description column are not generated by the lisp routine and will not appear in the Layer Manager. They have been included here for informational purposes.

2) Create an additional layer which will be used for manually drawing the path of the left front wheel. Name it C-TURN-TRCK-FLTR-PATH (Truck Front Left Tire Path). Set the Color to "green" and the Linetype to "Dashed" in order to remain consistent with the lisp generated layers; the routine uses "green" for Truck tire paths, "cyan" for Trailer tire paths and a "Dashed" linetype for both truck and trailer tire paths.

NOTE: You may change the layer colors and linetypes if desired but make certain to save your changes as a named layer state. Whenever the routine is reloaded into a drawing, it will recreate all of the layers, overwriting any changes you have made. You will need your saved layer state to restore them.

3) Create another new layer and name it C-TURN-VHCL-BLOCK (AASHTO Vehicle Block). Set the Color to "White" and the Linetype to "Continuous". Set the layer as current and insert the desired vehicle block from the Turn.lsp AASHTO Vehicle Block Library onto that layer.

4) Set the layer you created called C-TURN-TRCK-FLTR-PATH as current and draw a polyline representing the desired path of the **left front** wheel on that layer. Note that the routine **always** tracks along this polyline when modeling. Make sure that all lines and arcs comprising the polyline are tangent.

For clockwise turns, arcs **must** have radii greater than or equal to the minimum turning radius as listed by AASHTO's Green Book for the vehicle being modeled. AASHTO's Green Book shows vehicle minimum turn radii as tracking along the front left wheel and turning to the right (clockwise). Given that Turn.lsp also tracks along the front left wheel, a path drawn as clockwise only requires that the radius be greater than or equal to the minimum turning radius as listed by AASHTO. It is important to note that Turn.lsp will track along any path you create, regardless of whether the path is drawn properly or not. Be certain that your radii are drawn correctly!

For counterclockwise turns, radii of arcs must be calculated. When you turn to the left (counterclockwise) the right front wheel becomes the outermost tire. The problem here is that the routine tracks along the LEFT front tire, not the RIGHT front tire. Counterclockwise arc radii are calculated by subtracting the distance between the two front wheels (center to center) of the inserted Vehicle Block from the minimum turning radius as listed by AASHTO for the vehicle being modeled. Counterclockwise arcs **must** have radii greater than or equal to this number.

For your convenience, the below chart lists the AASHTO Minimum Turning Radii for all of the vehicles in the vehicle library along with the calculated counterclockwise arc radii needed by Turn.lsp to model counterclockwise turns. Simply look up the vehicle you are using for your modeling in the chart and make certain that clockwise turns have radii greater than or equal to the listed AASHTO Minimum Turn Radius and that counterclockwise turns have radii greater than or equal to the listed Calculated Counterclockwise Arc Radii.

Vehicle Type	**AASHTO Designation**	**AASHTO Minimum Turn Radius (Clockwise Arcs)**	**Center to Center Distance Between Two Front Wheels of Vehicle Block**	**Calculated Counterclockwise Arc Radii**
Articulated Bus	A-Bus	39.8′	8.5′	31.3′
Intercity Bus	Bus-40	45′	8.5′	36.5′
Intercity Bus	Bus-45	45′	8.5′	36.5′
City Transit Bus	City-Bus	42′	8.5′	33.5′
Motor Home	MH	40′	8′	32′

Motor Home and Boat Trailer	MH/B	50′	8′	42′
Passenger Car	P	24′	6′	18′
Passenger Car and Boat Trailer	P/B	24′	6′	18′
Passenger Car and Camper Trailer	P/T	33′	6′	27′
Conventional School Bus	S-Bus-36	38.9′	8′	30.9′
Large School Bus	S-Bus-40	39.4′	8′	31.4′
Single-Unit Truck	SU	42′	8′	34′
Intermediate Semitrailer	WB-40	40′	8′	32′
Intermediate Semitrailer	WB-50	45′	8′	37′
Interstate Semitrailer	WB-62	45′	8′	37′
Interstate Semitrailer	WB-65	45′	8′	37′
Interstate Semitrailer	WB-67	45′	8′	37′

5) Align the vehicle block with the polyline such that the vehicle block is at the same angle as the starting portion of the polyline. (If possible, make the starting portion of the polyline straight for a good distance before starting your turn. If the starting portion of the polyline is an arc, the vehicle block should be tangent to the arc.) You'll see a little circle in the center of the left front tire of the block. Make sure that the center of this little circle is sitting on the starting endpoint of the polyline. (If the starting portion of the polyline is an arc, the center of the little circle is the point of tangency.) Be certain that the path of the left front wheel is a **POLYLINE** and not line and arc segments. The polyline must always be drawn on the layer C-TURN-TRCK-FLTR-PATH, so make certain that layer is current when revising the path.

6) Type "turn" on the command line (no quotes) to run the routine.

7) At the prompt, enter "g" for generated vehicle. Hit "Enter" at the prompt that appears. This will enter the default which reads <select previously generated vehicle>.

8) Select the vehicle block.

9) Select the starting endpoint of the polyline.

10) A prompt appears that reads "Calculation step distance along front wheel path" along with a default value. The paths generated by Turn.lsp are not true arcs, but polylines made of many small line segments. In order for the generated paths to look like arcs, the length (step distance) of these line segments must not be too large. The default step distance value appearing at the prompt is calculated automatically by Turn.lsp based on the length of the wheelbase of the vehicle being modeled. There should be no need to change this value so accept the default and hit "Enter" at this prompt.

11) A prompt appears that reads "Number of calculation steps to skip between vehicle plots" along with a default value. The default value appearing here is automatically set by Turn.lsp as 50. This value controls the spacing between vehicle plots (plot frequency). The lower this value, the closer together vehicle plots will be and, therefore, the higher the plot frequency. The higher this value, the further apart vehicle plots will be and, therefore, the lower the plot frequency. It is recommended to accept the default of 50 and simply hit "Enter" at this prompt. If you find there are either too many or not enough instances of vehicle plots along the generated paths to suit your needs, you can change the value accordingly.