

IntControl (version 2.2)

The IntControl program is used to generate intersection controls for a TRANSIMS network. It uses sign and signal warrant files TRANSIMS Signalized Node, Unsignalized Node, Timing Plan, Phasing Plan, Detector, and Signal Coordinator Files.

IntControl program is a console-based program that runs in a command window on either Windows or Linux. The command syntax is:

IntControl [control_file]

The control_file is the file name of an ASCII file that contains the control strings expected by the program. The control_file is optional. If a file name is not provided, the program will prompt the user to enter a file name.

The program automatically creates a printout file based on the control_file name. If the file name includes an extension, the extension is removed and “.prn” is added. The printout file will be created in the current working directory and will overwrite an existing file with the same name.

Control File Parameters

Control parameters are defined using a control key followed by a string or number. The control parameters can be specified in any order. If a given key is defined more than once, the last instance of the key is used. The default value for each key is 0 or “Null”. Null parameters do not need to be included in the file. Note that comment lines or extraneous keys can be included in the file. They will be ignored by the program.

A typical IntControl control file is shown below:

TITLE	MPO Intersection Controls
NET_DIRECTORY	/u1/tdot/tdottech/projects/CONVERT/TransimsNet
NET_NODE_TABLE	Node
NET_LINK_TABLE	Link
NET_POCKET_LANE_TABLE	Pocket_Lane
NET_ACTIVITY_LOCATION_TABLE	Activity_Location
INPUT_FILE_FORMAT	TRANSIMS
INPUT_SIGN_FILE	Signs
SIGN_FILE_LINK_ID_FIELD	INLINK
SIGN_FILE_NODE_ID_FIELD	NODE
SIGN_FILE_SIGN_TYPE_FIELD	SIGN
INPUT_SIGNAL_FILE	Signals
SIGNAL_FILE_NODE_ID_FIELD	NODE
SIGNAL_FILE_SIGNAL_TYPE_FIELD	TYPE
NEW_DIRECTORY	/u1/tdot/tdottech/projects/CONVERT/TransimsNet
NEW_UNSIGNALIZED_NODE_TABLE	Unsignalized_Node
NEW_SIGNALIZED_NODE_TABLE	Fix_Signalized_Node
NEW_TIMING_PLAN_TABLE	Timing_Plan
NEW_PHASING_PLAN_TABLE	Phasing_Plan
NEW_DETECTOR_TABLE	Detector
NEW_SIGNAL_COORDINATOR_TABLE	Signal_Coordinator

SIGNAL_CYCLE_LENGTH	60
MINIMUM_PHASE_TIME	5
YELLOW_PHASE_TIME	3
RED_CLEAR_PHASE_TIME	1
SIGNAL_DETECTOR_LENGTH	37.5
POCKET_LANE_FACTOR	0.5
GENERAL_GREEN_FACTOR	0.5
EXTENDED_GREEN_FACTOR	0.6
SIGNAL_SPLIT_METHOD	CAPACITY
MINIMUM_LANE_CAPACITY	500
MAXIMUM_LANE_CAPACITY	1500
FIXED_TIME_SIGNAL_FIELD	AREATYPE
FIXED_TIME_FIELD_RANGE	1..2
PRINT_WARNING_MESSAGES	TRUE

The keys recognized by the IntControl program are listed below. These keys can be defined in a variety of different ways to perform different tasks.

TITLE

Any text string can be used on this line. This text is printed on the top of each output page.

NET_DIRECTORY

The network directory key is required. It specifies the path to the input network files.

NET_NODE_TABLE

The node table key is required. It specifies the name of the TRANSIMS node file within the network directory. The full path and file name for the node table is constructed by appending the value of this key to the value of the NET_DIRECTORY key.

NET_LINK_TABLE

The link table key is required. It specifies the name of the TRANSIMS link file within the network directory. The full path and file name for the link table is constructed by appending the value of this key to the value of the NET_DIRECTORY key.

NET_POCKET_LANE_TABLE

The pocket lane table key is required. It specifies the name of the TRANSIMS pocket lane file within the network directory. The full path and file name for the pocket lane table is constructed by appending the value of this key to the value of the NET_DIRECTORY key.

NET_ACTIVITY_LOCATION_TABLE

The activity location table key is required. It specifies the name of the TRANSIMS activity location file within the network directory. The full path and file name for the activity location table is constructed by appending the value of this key to the value of the NET_DIRECTORY key. The area type information in the activity location table is used by the IntControl program to generate fixed time signals.

INPUT_FILE_FORMAT

The input file format key is optional. This key specifies the file formats of the sign and the signal warrants files defined by keys “INPUT_SIGN_FILE” and “INPUT_SIGNAL_FILE”. The file formats supported by IntControl program are “TRANSIMS” (or tab-delimited files), “DBASE”, and “CSV” (or comma delimited files). This key defaults to TRANSIMS when the value is not provided.

INPUT_SIGN_FILE

This key is required and specifies the sign warrants file. This file stores the ID number of the node, ID number of the incoming link, type of control on the incoming link and a note on the signal type. A sample sign warrants file is shown below.

NODE	INLINK	SIGN	NOTES
8078	185	S	STOP SIGN
8082	194	S	STOP SIGN
8085	201	Y	YIELD SIGN
8085	202	S	STOP SIGN
8087	185	S	STOP SIGN
8094	201	S	STOP SIGN
8130	261	Y	YIELD SIGN
8155	310	S	STOP SIGN
8165	324	Y	YIELD SIGN
8166	328	S	STOP SIGN
8178	286	S	STOP SIGN
8178	352	Y	YIELD SIGN
8178	354	S	STOP SIGN
8179	353	S	STOP SIGN
8179	356	S	STOP SIGN
8183	364	S	STOP SIGN

Typically the input sign warrant file is generated by the TransimsNet program. The user could either directly use the Sign warrants file generated by the TransimsNet program or could modify the file and use it as an input for the IntControl program. NOTES field in the sample file shown above is optional.

SIGN_FILE_LINK_ID_FIELD

This key is optional. This key defines the field in the input sign warrants file that contains the Link Ids. The default value for this key is “LINK_ID” and this key is not used when the INPUT_FILE_FORMAT is set as TRANSIMS or NULL.

SIGN_FILE_NODE_ID_FIELD

This key is optional. This key defines the field in the input sign warrants file that contains the Node Ids. The default value for this key is “NODE_ID” and this key is not used when the INPUT_FILE_FORMAT is set as TRANSIMS or NULL.

SIGN_FILE_SIGN_TYPE_FIELD

This key is optional. This key defines the field in the input sign warrants file that contains sign type. The valid sign types are “Y” (yield signs) and “S” (stop signs). The default value for this

key is “TYPE” and this key is not used when the INPUT_FILE_FORMAT is set as TRANSIMS or NULL.

INPUT_SIGNAL_FILE

This key is required and specifies the signal warrants file. This file stores the Node ID numbers for the signalized nodes and flags the signal type as “A” (actuated) or “T” (fixed time). A sample signal warrants generated by TransimsNet program is shown below. The user could either directly use the signal warrants file generated by the TransimsNet program or could modify the file and use it as an input for the IntControl program. The NODE and TYPE fields are the only essential fields required to run the IntControl program.

NODE	TYPE	PLAN	OFFSET	STARTTIME	COORDINATR	RING	ALGORITHM	NOTES
8002	A	0	0	ALL00:00	8002 S	B	SIGNAL WARRANT	
8003	T	0	0	ALL00:00	8003 S	B	SIGNAL WARRANT	
8006	A	0	0	ALL00:00	8006 S	B	SIGNAL WARRANT	
8007	T	0	0	ALL00:00	8007 S	B	SIGNAL WARRANT	
8009	A	0	0	ALL00:00	8009 S	B	SIGNAL WARRANT	
8010	T	0	0	ALL00:00	8010 S	B	SIGNAL WARRANT	
8011	A	0	0	ALL00:00	8011 S	B	SIGNAL WARRANT	
8015	T	0	0	ALL00:00	8015 S	B	SIGNAL WARRANT	
8016	A	0	0	ALL00:00	8016 S	B	SIGNAL WARRANT	
8017	A	0	0	ALL00:00	8017 S	B	SIGNAL WARRANT	

SIGNAL_FILE_NODE_ID_FIELD

This key is optional. This key defines the field in the input signal warrants file that contains the Node Ids. The default value for this key is “NODE_ID” and this key is not used when the INPUT_FILE_FORMAT is set as TRANSIMS or NULL.

SIGNAL_FILE_SIGNAL_TYPE_FIELD

This key is optional. This key defines the field in the input signal warrants file that contains signal type. The valid signal types are “A” (actuated signals) and “T” (fixed time signals). The default value for this key is “TYPE” and this key is not used when the INPUT_FILE_FORMAT is set as TRANSIMS or NULL.

NEW_DIRECTORY

The new directory key is required. This key specifies the output directory where the output files get written.

NEW_UNSIGNALIZED_NODE_TABLE

The new unsignalized node table key is required and specifies the filename of the output unsignalized node table generated by the IntControl program.

NEW_SIGNALIZED_NODE_TABLE

The new signalized node table key is required and specifies the filename of the output signalized node table generated by the IntControl program.

NEW_TIMING_PLAN_TABLE

The new timing plan table key is required and specifies the filename of the output timing plan table generated by the IntControl program.

NEW_PHASING_PLAN_TABLE

The new phasing plan table key is required and specifies the filename of the output phasing plan table generated by the IntControl program.

NEW_DETECTOR_TABLE

The new detector plan table key is required and specifies the filename of the output detector table generated by the IntControl program.

NEW_SIGNAL_COORDINATOR_TABLE

The new signal coordinator table key is required and specifies the filename of the output signal coordinator table generated by the IntControl program.

SIGNAL_CYCLE_LENGTH

The signal cycle length key is optional and defines the cycle length of a signal. The default value for this key is 60 seconds. The minimum and the maximum values that can be defined for this key are 30 seconds and 240 seconds respectively.

MINIMUM_PHASE_TIME

The minimum phase time key is optional and defines the minimum time for a phase of a signalized intersection. The default value for this key is 5 seconds. The minimum phase time should be at least 1 second and the value should not be greater than half the value of signal cycle length.

YELLOW_PHASE_TIME

The yellow phase time key is optional. This key defines the length of the yellow interval in seconds. The default value for this key is 3 seconds. The minimum and the maximum values that could be specified for this key are 1 and 5 seconds respectively.

RED_CLEAR_PHASE_TIME

The red clear phase time key is optional. This key defines the length of the red clearance interval in seconds. The default value for this key is 1 second. The minimum and the maximum values that could be specified for this key are 1 and 5 seconds respectively.

SIGNAL_DETECTOR_LENGTH

The signal detector length key is optional. This key specifies length of the detectors in meters. The default value for the detector length is 20 m. The minimum and the maximum values that could be specified for this key are 5 and 50 meters respectively.

POCKET_LANE_FACTOR

The pocket lane factor key is optional. This key specifies the weighting factor for the length of the pocket lane. The default value for this key is 0.5. The value for this key could range between 0.0 and 1.0.

GENERAL_GREEN_FACTOR

The general green factor key is optional. This key specifies the weighting factor for the general green time. The default value for this key is 1.0. The value for this key could range between 0.5 and 1.0.

EXTENDED_GREEN_FACTOR

The extended green factor key is optional. This key specifies the weighting factor for the extended green time. The default value for this key is 0.6. The value for this key could range between 0.0 and 1.0.

SIGNAL_SPLIT_METHOD

The signal split method key is optional. The accepted values for this key are “CAPACITY” and “LANES”. The default split method used by IntControl program for generating the timing plans of signalized intersections is “CAPACITY” method.

MINIMUM_LANE_CAPACITY

The minimum lane capacity field is optional. This key specifies the minimum capacity of a lane. This key is not used when the SIGNAL_SPLIT_METHOD key is set as “LANES”. The default value for this key is 500 vphpl.

MAXIMUM_LANE_CAPACITY

The maximum lane capacity field is optional. This key specifies the maximum capacity of a lane. This key is not used when the SIGNAL_SPLIT_METHOD key is set as “LANES”. The default value for this key is 1500 vphpl and the value specified should be greater than the value specified for the MINIMUM_LANE_CAPACITY field.

FIXED_TIME_SIGNAL_FIELD

The fixed time signal field is optional. This key specifies the field in the activity location table that has the area type information necessary for flagging the nodes as signalized intersections with fixed controls. The default value for this key is “AREATYPE”.

FIXED_TIME_FIELD_RANGE

The fixed time signal field range is optional. This field specifies the range of area type values in the activity location table that should have fixed time controls. The range should be specified as [Initial Value].[Final Value].

PRINT_WARNING_MESSAGES

The print warning messages key is optional. When this key is set as “TRUE” the IntControl program generates additional warning messages in the “*.prn” file.

Algorithm Notes

The IntControl program reads the signal and the sign warrant files input by the user and identifies the signal and the sign types associated with the nodes. The software displays appropriate error messages if the nodes in the signal or the sign warrants file do not exist in the node table.

The software reads the input TRANSIMS link file and verifies whether the link end nodes exist in the node file. Appropriate error messages are displayed if the end nodes of the links do not exist in the node file. The lane capacities are computed by dividing the directional capacity with the number of lanes. If the computed lane capacity is less than the minimum lane capacity defined by the MINIMUM_LANE_CAPACITY field, the software resets the computed lane capacity to be equal to the user specified minimum lane capacity. The numbers of approach and departure links are estimated before determining the phasing and the timing plans. For a given link the software identifies the thru link and then determines whether protected left turns are warranted. When left turns pockets are coded on both the approaches, the software assigns a protected left phase followed by general green. When left turn pockets are present on only one of the approaches, the software assigns a protected left and thru phase followed by the general green. If no left turns are present, the software assigns a general green phase with no turn protections.

When Left Turns are present on both the links, the phase time is computed by using the expressions below:

$$\begin{aligned} \text{Thru Phase Time} = & \text{General Green Factor} * \\ & (\text{Capacity of Link1} * (\text{Number of Regular Lanes on Link1} + \\ & \text{Number of Right Turn Pocket Lanes on Link1} * \text{Pocket_Factor}) + \\ & \text{Capacity of Link2} * (\text{Number of Regular Lanes on Link2} + \\ & \text{Number of Right Turn Pocket Lanes on Link2} * \text{Pocket_Factor})) \end{aligned}$$

The software also assigns the “Right on Red Phases” for different approaches. After determining the number of phases the split times for the different phases are estimated. The timing plans are then derived based on the split times for different phases. The phase time is used to determine the minimum green time. The “GREENNEXT” value is set for actuated signals by factoring the phase time with the extension factor. The detector table is generated for storing detector information for actuated signals. Also a signal coordinator file that contains the list of all signalized node Ids is generated. The IntControl program also reads the sign warrants file and generates the unsignalized node file.

Sample Printout

The printout file generated by IntControl will look something like the example below. It is an ASCII text file with a maximum of 95 characters per line and 65 lines per page. The file can be viewed or printed using a variety of text editors. For best results in a word processor, use a 10-point Courier font and 0.5 inch margins on all sides.

```
*****
|
|      IntControl - Version 2.2
|      Copyright (c) 2004 by AECOM Consult
|      Fri Aug 27 15:02:47 2004
|
|*****
```

```
Control File = IntControl.ctl
Number of Keys Kept/Read = 35/35
```

MPO Intersection Controls

```
TRANSIMS Network Directory = /u1/tdot/tdottech/projects/CONVERT/TransimsNet
TRANSIMS Node Table = Node
TRANSIMS Link Table = Link
TRANSIMS Pocket Lane Table = Pocket_Lane
TRANSIMS Activity Location Table = Activity_Location
```

Input File Format = TRANSIMS

Input Sign File = /u1/tdot/tdottech/projects/CONVERT/TransimsNet/Signs

Input Signal File = /u1/tdot/tdottech/projects/CONVERT/TransimsNet/Signals

```
New TRANSIMS Network Directory = /u1/tdot/tdottech/projects/CONVERT/TransimsNet
New TRANSIMS Unsignalized Node Table = Unsignalized_Node
New TRANSIMS Signalized Node Table = Fix_Signalized_Node
New TRANSIMS Timing Plan Table = Timing_Plan
New TRANSIMS Phasing Plan Table = Phasing_Plan
New TRANSIMS Detector Table = Detector
New TRANSIMS Signal Coordinator Table = Signal Coordinator
```

Cycle Length = 60 seconds
Minimum Phase = 5 seconds
Yellow Phase = 3 seconds
Red Clear Phase = 1 second

Detector Length = 37.50 meters
 Pocket Lane Weighting Factor = 0.50 of a Thru Lane
 General Green Weighting Factor = 0.50 of the Combined Approach
 Extended Green Factor = 0.60 of Minimum Green Time

Signal Split Weighting Method = CAPACITY
Minimum Lane Capacity = 500 vphpl
Maximum Lane Capacity = 1500 vphpl
Fixed Time Signal Field Name = AREATYPE

```
Fixed Time Signal Field Range = 1..2
Control Warning Message Flag = TRUE
```

Number of Node Records = 5934
Number of Link Records = 8469
Number of Pocket Lane Records = 3764
Number of Activity Location Records = 39582
Number of Input Sign Records = 2891
Number of Input Signal Records = 1417
Number of Fixed Time Signals = 403

Number of Signal Records Skipped = 0
Number of Warning Messages = 0
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Number of Unsignalized Node Records = 10493
Number of Signalized Node Records = 1417
Number of Timing Plan Records = 1417
Number of Phasing Plan Records = 10979
Number of Detector Records = 4740
Number of Signal Coordinators = 1417