



# Navigation System Data Entry: Estimation of Task Times

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Paul Green

University of Michigan  
Ann Arbor, Michigan, USA  
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## PURPOSE

- provide background material to help develop SAE Recommended Practice J2365 (Calculating the Time to Complete In-Vehicle Navigation and Route Guidance Tasks)
- provide information to enhance the safety and usability of driver interfaces

## LITERATURE SUMMARY

Study	Findings and Comments
Kurokawa (1990)	<ul style="list-style-type: none"> <li>• dissertation with extensive data from on-road and simulator studies of control and display use</li> <li>• emphasis on conventional systems</li> <li>• HyperCard program to predict task times, hand-off-wheel time, # of glances and total glance time to IP, # of glances to road</li> <li>• requires extensive data for predictions (driver age, workload, exact location of device, size and luminance of labels, etc.)</li> <li>• software is not publicly available</li> <li>• being incorporated into model being developed for FHWA</li> </ul>
Levison (1993), Levison and Corker (1995)	<ul style="list-style-type: none"> <li>• development of Integrated Driver Model</li> <li>• includes optimal control model for steering and procedures model for in-vehicle tasks</li> <li>• software is not publicly available</li> <li>• software requires modification for each application</li> <li>• being incorporated in FHWA Integrated Highway Safety Design Model</li> </ul>
NASA MIDAS	<ul style="list-style-type: none"> <li>• used to model aircraft cockpit tasks and control rooms</li> <li>• requires SGI workstation</li> <li>• key elements are Jack, Legibility Modeling Tool, and Cockpit Design Editor</li> <li>• no automotive applications to date</li> </ul>
HOS and Integrated Human Performance Modeling Environment	<ul style="list-style-type: none"> <li>• commercial software used by human factors professionals</li> <li>• Monte Carlo simulation software for discrete tasks</li> <li>• no automotive applications</li> </ul>

Comment: There is no publicly available PC software for automotive applications.

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**PROPOSED METHOD** (based on GOMS and UMTRI data)

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1. Obtain a working model or step-by-step operational description of the device.
2. Identify the major user operational goals (and 3, subgoals).
4. Identify the methods used to achieve all goals and subgoals
5. Generate pseudo code for all methods.
6. Identify the assumptions (users' knowledge of various methods, extent to which switch operation and cognitive activities occur in parallel, the use of shortcuts, etc.)

7. Determine the appropriate mental, keystroke, and other operators for each step. Mental times are 2.2 s. Search times are 2.29 s.

Key Category	Keystroke		
	1st	2nd	>2nd
Cursor	1.71	0.69	0.47
Enter	1.55		
Letters	1.54	0.99	
Numbers	1.15	0.47	
Shift	1.46		
Space	0.60		

8. Enter the times for each operator.
9. Add up the execution times for each operator using a spreadsheet.
10. Adjust the keystroke times using the age multiplier (1.4 for drivers ages 40-55, 2.2 for drivers over 65.
11. Verify that the times are reasonable and adjust as needed.

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**KEY REFERENCES**

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- Green, P. (1999). The 15-Second Rule for Driver Information Systems, ITS America Ninth Annual Meeting Conference Proceedings, Washington, D.C.: Intelligent Transportation Society of America, CD-ROM.
- Green, P. (1999). Estimating Compliance with the 15-Second Rule for Driver-Interface Useability and Safety, Proceedings of the Human Factors and Ergonomics Society 43rd Annual Meeting, Santa Monica, CA: Human Factors and Ergonomics Society (to appear).
- Society of Automotive Engineers (1998). SAE Recommended Practice for Calculating the Time to Complete In-Vehicle Navigation and Route Guidance Tasks (SAE J2365), Committee Draft of November 23, Warrendale, PA: Society of Automotive Engineers.
- Society of Automotive Engineers (1999). SAE Recommended Practice for Navigation and Route Guidance Function Accessibility While Driving (SAE 2364), Committee Draft of June 8, Warrendale, PA: Society of Automotive Engineers.