

TMC Staffing and Scheduling for Day-to-Day Operations

Staffing and Scheduling Resources

The efficient operation of a transportation management center (TMC) depends on the effective management of personnel. Past developments in staff planning and scheduling systems used to support the operation of TMCs have been limited. The *TMC Staffing and Scheduling for Day-to-Day Operations* project was initiated to create two resources for managers, supervisors, human resources personnel, and private contractors who are responsible for work analysis, scheduling, and staff planning decisions in TMCs. The first resource is a technical document that provides guidance, useful strategies, and recommended practices to ensure that TMCs make effective staffing and scheduling decisions. Effective staffing and scheduling require that TMCs determine the appropriate number of employees needed to meet service demands and that the employees possess the attributes necessary to perform their work successfully. The second resource is an easy-to-use scheduling tool that automates three of the scheduling procedures described in the technical document.

The Importance of Staffing and Scheduling

TMCs provide a vital service to community residents by safeguarding travelers, providing cost and time savings, and decreasing pollutants released into the air by motor vehicles. In the service industry, employees are the most critical element in the delivery of the service to consumers. In addition, payroll costs of service employees typically account for the greatest percentage of the operating budget. As a result, the human resource management of a service operation requires well-informed and accurate scheduling and staffing decisions.

Work Analysis Techniques

The technical document reviews three work analysis techniques that support scheduling and staffing decisions.

Job analysis is a method used to determine the elements of work and the employee characteristics necessary to perform each element.

Workload analysis yields design principles that maximize the performance capability of employees in a work system.

Demand analysis is a collection of techniques used to forecast future employee scheduling requirements.

Staffing and Scheduling Challenges

Generating employee schedules and staffing plans requires TMCs to overcome a variety of challenges. Often, TMCs must reconcile conflicting requirements and constraints placed on staffing and scheduling systems:

- Budget constraints
- Employee preferences
- Differences in employee skills and performance levels
- Government regulations
- Workspace constraints
- Organizational policies
- Varying consumer demand

Meeting Demands for Services

Employee schedules are typically constructed to meet projected levels of workload based on consumer demands for service. Three general approaches to scheduling include dedicated shifts, rotating shifts, and flexible schedules that change over each planning horizon.

Staffing arrangements and personnel decisions

increase the flexibility of using human resources to meet demands for services by consumers. Common staffing arrangements include full-time employment, part-time employment, job sharing, temporary employment, and contract positions. Common personnel decisions include the use of overtime, promotion, redeployment, and cross training.

Employee scheduling strategies may be implemented by TMC employees to adapt to demanding work schedules. Human factors principles have been applied to the hours employees work to determine optimal sleep and meal times, alertness management strategies, and other adjustment strategies that help to ensure high job performance, safety, health, and general well-being.

Employer scheduling strategies focus on aspects of work that managers and supervisors oversee, including recruitment and compensation practices, job and schedule design, and environmental conditions. Interventions that improve employee health and safety may also decrease accidents, sick leave, and costs, and increase employee productivity.

Contents of the Technical Document

The technical document consists of seven chapters covering the following topics:

- Chapter 1: Introduction and Overview
- Chapter 2: Work Analysis
- Chapter 3: Scheduling Practices
- Chapter 4: Introduction to Shiftwork
- Chapter 5: Strategies for Employees
- Chapter 6: Strategies for Employers
- Chapter 7: Staff Planning

Not only are both of the scheduling algorithms easy to use, both algorithms have been found to generate efficient schedules in comparison to other scheduling methods, under a variety of conditions. To evaluate the quality of each schedule generated by the tool, two numeric assessments are provided in the output: the number of excess hours per week and the scheduling efficiency.

The *number of excess hours per week* is equal to the number of employee hours scheduled in excess of those needed to satisfy the specified demand, which is an assessment of the amount of overstaffing.

Scheduling efficiency is the ratio of the number of employee hours required to the number of employee hours scheduled. A 100% scheduling efficiency (peak efficiency) is ideal; values less than 100% indicate overstaffing, and values greater than 100% indicate understaffing.

The tool also calculates the **relief factor**, or average over-coverage percentage, which indicates the number of employees that are required to cover a group of positions after accounting for employee absences (e.g., vacation days, sick leave) and other relief days (e.g., training days).

TMC Staffing and Scheduling Tool

The TMC Staffing and Scheduling Tool automates three of the manual scheduling procedures described in the technical document: shift scheduling, days-off scheduling, and the calculation of the relief factor.

The tool allows users to define any number of shifts of any duration to which personnel can be assigned. The tool also allows users to enter the amount of demand (in terms of the number of operators required) for each hour of each day over a one week planning horizon. The data that users input into the scheduling algorithms is easy to modify to assess how changes in demand affect employee schedules.

The **shift scheduling** algorithm assigns employees to shifts with variable start times to cover the forecasted demand. A demand analysis can be used to forecast the amount of demand.

The **days-off scheduling** algorithm assigns employees to a five-on/two-off work week based on the number of employees required each day. The number of employees required each day can be derived from the output of the shift-scheduling algorithm.

The schedules generated by the program may be exported from the program and saved for later use.

Inputs

Shift work hours:

Shift	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Number of operators required by day and hour:

Day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Monday	2	2	2	2	4	9	11	10	9	5	3	3	3	3	5	7	8	9	8	6	4	2	2	2
Tuesday	2	2	2	2	4	9	10	10	8	5	3	3	3	3	4	6	7	8	7	6	4	2	2	2
Wednesday	2	2	2	2	4	9	10	10	8	5	3	3	3	3	4	6	7	8	9	6	4	2	2	2
Thursday	2	2	2	2	4	9	10	10	8	5	3	3	3	3	4	6	7	8	7	6	4	2	2	2
Friday	2	2	2	2	5	6	7	7	6	4	3	3	3	4	7	9	10	11	9	5	3	2	2	2
Saturday	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
Sunday	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1

Outputs

Output is up to date.

Employees needed for each day and shift:

Day	Shift 1	Shift 2	Shift 3
Monday	11	9	9
Tuesday	10	8	8
Wednesday	10	8	8
Thursday	10	8	8
Friday	7	9	11
Saturday	1	2	2
Sunday	2	2	2

Employees by first day of work week and shift:

Day	Shift 1	Shift 2	Shift 3
Monday	6	8	9
Tuesday			
Wednesday			2
Thursday	1	1	
Friday			
Saturday	1	1	
Sunday	3		

Excess hours per week: 628
Scheduling efficiency: 51%

The technical document and the software tool are available for download from the project website:

http://tmcdfs.ops.fhwa.dot.gov/cfprojects/new_detail.cfm?id=63&new=0

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For More Information about the TMC Pooled-Fund Study, See
<http://tmcdfs.ops.fhwa.dot.gov>

Call the FHWA Toll-Free Help Line:
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