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# VMS AND HAR MESSAGE PROJECT

# IMPROVING THE HIRING, RETENTION, AND DEVELOPMENT OF NEW JERSEY DEPARTMENT OF TRANSPORTATION TRAFFIC OPERATIONS CENTER STAFF: EXECUTIVE SUMMARY

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This document is an executive summary of an assessment of ways that the New Jersey Department of Transportation (NJDOT) could improve hiring and maintaining adequate levels of staffing with the required knowledge, skills, and abilities in its Transportation Operations Centers (TOCs). The information contained herein should be useful to other agencies in the region that operate TOCs as well.

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# IMPROVING THE HIRING, RETENTION, AND DEVELOPMENT OF NEW JERSEY DEPARTMENT OF TRANSPORTATION TRAFFIC OPERATIONS CENTER STAFF

## INTRODUCTION

New Jersey Department of Transportation (NJDOT) Traffic Operations Centers (TOCs) serve a vital role in maximizing mobility of travelers throughout New Jersey and the entire Northeast Corridor. Decisions made and actions taken by TOC operators directly influence the operational efficiency of the roadway system in the region, and affect the overall levels of public opinion of NJDOT. Having a competent, qualified, and motivated TOC workforce is therefore essential if these centers are to continue to be successful in the future.

Similar to agencies operating TOCs in other parts of the country, though, the NJDOT has experienced some difficulties in continuing to meet the staffing needs of its centers. The functions and tasks typically performed in a TOC require staff with knowledge, skills, and abilities outside the range of existing employee title structures, position descriptions, and salary levels available within the department. At the same time, the continuous (or nearly so) operation of a TOC means that staff are typically faced with non-standard and sometimes varying shift schedules, periods of intense work activity during major incident conditions and such, as well as periods of fairly light work that can potentially result in periods of operator boredom.

Because of these unique challenges, NJDOT contracted with the Texas Transportation Institute (TTI) to assess and recommend ways that the agency could improve hiring and maintaining adequate levels of staffing with the required knowledge, skills, and abilities in its TOCs. The researchers' recommendations resulting from that assessment are summarized in the sections that follow.

## RECOMMENDED TOC OPERATOR POSITION DESCRIPTIONS

### New positions should be established specifically for traffic operations center operators in New Jersey.

TTI researchers compared and critiqued recent FHWA *Guidelines* [(1)], which describe necessary TOC operator knowledge, skills, and abilities (KSAs), to the position descriptions currently utilized by NJDOT for TOC operator positions. The researchers found the NJDOT descriptions lacking in their identification of KSAs needed for an applicant to effectively function within typical traffic management system software, to properly interpret traffic flow conditions and parameters in the various forms available in a TOC (from video, as graphs or tables on a computer screen), and to adequately assimilate and interpret various

kinds of spatially-located data (roadway locations and direction, proper viewing orientation of video cameras, etc.).

Researchers have prepared recommended KSAs for entry-level and fully-trained TOC operators to be developed into NJDOT position descriptions by the NJDOT Human Resources and New Jersey Department of Personnel (NJDOP). These KSA tables are included in the Appendix. It is recommended that NJDOT Human Resources and NJDOP ensure that the new positions are designed to facilitate possible transfers between these titles and other engineering technician positions outside of the TOC.

## RECOMMENDED TOC OPERATOR PAY SCALE

**The salary structure for entry-level TOC operators should meet or exceed $27,100 in high cost-of-living areas, as agencies that utilize pay scales below this value reported having significant difficulties attracting and retaining operators in their TOCs.**

TTI researchers gathered data from other state TOCs regarding operator pay scales, and found that such values ranged between $20,000 and $50,900 annually. The authors of the FHWA *Guidelines* performed a skill-based assessment of federal positions with comparable KSA requirements, and concluded that the comparable federally-based salary for these types of positions is between $27,100 and $37,400 annually for high cost-of-living locations.

## RECOMMENDED TOC OPERATOR STAFFING LEVELS

**NJDOT TOCs should strive to maintain staffing levels at one operator for every 26 centerline miles of roadway responsibility in the TOC per 40 hours of operation per week, or one operator for every 15 variable message signs of responsibility per 40 hours of TOC operation per week.**

TTI researchers found considerable variation across the country with regard to the staffing levels utilized in the TOCs. TOCs were found to have one operator on staff for every 3 to 45 variable message signs (VMSs) in the system for each 40 hours of TOC operation per week. Similarly, the rate of staffing was found to be about one operator for every 12 to 105 centerline miles of surveillance responsibility in the system for every 40 hour of TOC operation. The best determination of staffing needs still reside with the individual TOC managers.

At the request of the Project Advisory Committee, researchers also reviewed operator work shift information from the other TOCs to determine if any utilized 12-hour shifts. None of the other TOCs surveyed utilized work shifts this long except for unusual situations (i.e., special events) and so did not have any experiences to relay forward. Consequently, researchers could offer no

suggestions as to the value of utilizing this length of shift, nor could any advice or issues to avoid be offered if NJDOT chooses to pursue shifts of this length in the future.

## RECOMMENDED OPERATOR TRAINING PROGRAMS

**Available National Highway Institute (NHI) courses should not be actively pursued as part of TOC operator development, but be considered for operator attendance if they are brought to New Jersey by another group within NJDOT and opened up to other employees.**

**Also, NJDOT TOC supervisor personnel should consider enrolling some of their existing operators in on-line and CD-ROM courses offered through the Consortium for ITS Training and Education (CITE) courses to determine their usefulness to operator development.**

Although TOC functions and activities (as well as agency credibility overall) depend heavily on proper operator decisions and actions, very few of the TOCs contacted had formal training programs in place. Rather, most of the training was being provided on the job, without any formal structure to the information being provided, its accuracy, or methods of assessing operator understanding of the concepts. The authors of the FHWA *Guidelines* recommended desired areas of training for TOC operators based on their assessment of the few agencies that have formal training programs to teach the more advanced concepts and principles needed to fully understand the mission and functions of the TOC. Researchers reviewed several potential sources of training, and identified the following opportunities that address these topic areas.

- Principles and Practices of Technical Traffic Engineering
  - *Highway Capacity and Quality of Flow – National Highway Institute (NHI) Course 133005A*
  - *Freeway Traffic Operations – NHI Course 133075A*
  - *Managing Traffic Incident and Roadway Emergencies – NHI Course 133048A*

    or
  - *Incident and Emergency Management – Consortium for ITS Training and Education (CITE)*
  - *Traffic Flow Theory as Applied to ITS – CITE*
  - *Signal Timing Concepts – CITE*

- Variable Message Sign Message Design and Display
  - *A training program on variable message sign message design and display was developed by TTI researchers as part of the VMS and HAR Message Project and is readily available to NJDOT.*

- Creative Problem Solving
  - *Enhancing Creativity in the Workplace -- New Jersey Department of Personnel Human Resources Development Institute (HDRI)*
  - *New Methods in Problem Solving and Decision Making -- HDRI*

- Trouble Shooting Software/Equipment Problems
  - *The Tools of Advanced Transportation Management Systems (ATMS) – CITE*

- Team Building and Conflict Resolution
  - *Advanced Communication Skills – HDRI*
  - *Dealing with Difficult People – HDRI*

The courses by NHI and by HDRI require allocation of significant periods of time for the operators to attend, which can make shift scheduling by the TOC manager or supervisor more difficult. In addition, the NHI courses require a minimum number of participants in order to schedule and conduct the class.

The researchers are not intimately familiar with the curriculum being offered by CITE. However, it is on-line or CD-ROM based and so can be more easily accommodated within TOC operations. Theoretically, operators could even utilize the slow times of normal work shift to participate in these types of training modules.

## REFERENCES

[1] Baxter, D.H. *Guidelines for TMC Transportation Management Operations Technician Staff Development.* Report No. FHWA-OP-03-071. FHWA, U.S. Department of Transportation, Washington, DC. October 2002.

# APPENDIX:

## RECOMMENDED ENTRY-LEVEL AND FULLY-TRAINED OPERATOR KSAs

DESIRED ENTRY-LEVEL KNOWLEDGE FOR NJDOT TOC OPERATORS

- Knowledge of standard computer workstation operations in Microsoft Windows-type applications environment.
- Knowledge of operation of hold, transfer, speak, listen, speed dial, and other standard business telephone headset features.
- Knowledge of numeric and text data entry and standard editing procedures using a computer keyboard and/or mouse.
- Knowledge of what a computer operating system, a software application, and a data base represents.
- Knowledge on how to use highway maps, video image displays, graphical and text data, and transportation icons to identify physical locations in the covered areas of the system.
- Knowledge of appropriate language and interpersonal communication (listening and speaking) used to conduct commonly used, business-related oral communications.
- Knowledge of local political jurisdictions and institutional relationships.
- Knowledge of key traffic origins and destinations in the covered areas, knowledge of the roadway network and travel conditions by time of day.

ADDITIONAL KNOWLEDGE DESIRED FOR FULLY-TRAINED NJDOT TOC OPERATORS

- Knowledge of operation of channeled two- way radio headset with selectable frequencies.
- Knowledge of impact of adverse weather on transportation systems, including wind, precipitation, temperature extremes, and airborne particulates (smog, fog, smoke, etc.).
- Knowledge of closed-circuit television (CCTV) camera locations and orientation, pan/tilt/zoom camera controls, camera pre-sets, iris functions, and white balance.
- Knowledge of NJDOT public policy principles including customer service, regulation, enforcement, liability, accountability, responsibility, information dissemination, controlled conduct.
- Knowledge of traffic flow characteristics such as speed, velocity, volume, average speed, density, percent occupancy, demand, and capacity.
- Knowledge of roadway geometry and lane configuration, direction, coordinates, links, nodes, zones, sections, mileposts, station numbering.
- Knowledge of general traffic surveillance, control, and data acquisition (SCADA) alarm principles.
- Knowledge of agency radio call signs and protocols.
- Knowledge of traffic law and incident management policies for NJDOT and responders including police agencies.
- Understanding of general traffic signal operations concepts including cycle, split, offset, detectorization and coordination, timing plans, zones, master/slave concepts, saturation, transition cycles, capacity utilization and flow characteristics, and queuing.
- Understanding of what variable speed limits, lane closures, ramp closures, and/or road closures for highways, tunnels, and bridges are meant to accomplish.
- Knowledge of incident response plan generation and traffic management procedures.
- Knowledge of the incident command system used in areas covered by the NJDOT TOCs.

DESIRED ABILITIES FOR NJDOT TOC OPERATORS

- Ability to comprehend and read English
- Ability to articulate and speak clearly
- Ability to compose full and partial sentences using correct English grammer, spelling, and punctuation
- Proficiency in using the Microsoft Windows Operating System.
- Ability to understand traffic information from visual sources in a transportation schematic.
- Ability to memorize policies related to job duties.
- Ability to read and interpret technical data related to computers and software.
- Ability to follow written instructions with minimal supervision under time pressure.
- Ability to work closely and cooperatively with others in a professional business environment.
- Ability to perform under pressure, including when communications are recorded for third party review.
- Correctly interpret data assembled in a two-dimensional array format
- Ability to scan multiple television monitors and note changes over time to objects and images
- Ability to obtain security clearance and pass a background check (if co-located with police).

DESIRED ENTRY-LEVEL SKILLS FOR NJDOT TOC OPERATORS

- Skill to navigate between four or more multiple open application windows in a computer system.
- Skill to enter a minimum of 20 words/numbers per minute with 97 percent accuracy on a computer keyboard.
- Skill to use available computer software macros to accelerate editing of data.
- Skill to execute a single computer control command for a single device (with proper orientation of the operating system).
- Skill to match closed-circuit television camera orientation with static images to determine the orientation of the roadway camera in the field of view.
- Skill to note changed or unusual conditions or appearance of emergency icons on the computer screen within 30 seconds.
- Skill to perform duties consistent with agency policies. Correctly identify situations not conforming to these policies and notify supervisor within 2 minutes.
- Skill to remember or find reference material on policies within 2 minutes.
- Skill to implement error free procedures on the computer system within 2 attempts.
- Skill to communicate effectively, capturing and conveying important information while minimizing superfluous verbiage, slang, and lost data.
- Skill to determine if data viewed on a computer screen is abnormal, anomalous, within or outside a range or threshold.
- Skill to determine if image objects viewed from television monitors are abnormal, anomalous, and reflect any danger to safe and efficient transportation.
- Skill to detect a single event from 6 video-captured still images, in 10 seconds.
- Skill to work two consecutive hours with sufficient focus to respond to audio alarms received in less than 10 seconds, and visual alarms in less than 30 seconds.
- Skill to work two consecutive hours with 100% accuracy taking note of randomly recurring events, at the rate of at least 20 events per hour.
- Skill to memorize all required radio dispatch call signs and policies, and have less than a 3 percent violation rate of protocols.
- Skill to provide effective route information to aid motorist in reaching a destination in a courteous and professional manner.

ADDITIONAL SKILLS DESIRED FOR FULLY-TRAINED NJDOT TOC OPERATORS

- Listen to, and correctly interpret, information from callers, including police dispatchers, other TOC operators, and the public.
- Ability to convey important information succinctly with minimal verbiage.
- Quickly switch between telephone lines without lost calls, use speed and multi-channel dialing.
- Skill in anticipating safety and traffic flow implications of weather fluctuations and events.
- Skill in recognizing weather information values that are out of acceptable ranges.
- Skill in selecting television camera, locating, and zooming in on incident in 360 degree field of view in 30 seconds or less.

ENTRY-LEVEL EDUCATION AND EXPERIENCE FOR NEW JERSEY TOC OPERATORS

- Minimum of high school education with 1 year of engineering-related experience and 2 years of on-the-job experience using computers

In addition, one or more of the following is desirable:

- 4 years of experience on 2 roadway systems, advanced map reading level as demonstrated by experience as either emergency medical technician (EMT) driver or US Army private first class (or equivalent), and 20/20 corrected vision.
- 4 years experience on-the-job in position requiring adherence to policy and procedure.
- 2 years participating in goal-directed teams.
- Completion of course material on highway capacity and freeway flow or 2 years experience in a TOC utilizing traffic flow parameters, and demonstrated ability.
- 2 years experience on-the-job with automated alarms in a traffic surveillance, control, and data acquisition work environment, dispatch center, or similar facility, and demonstrated skill level.
- Alternatively, two weeks of advanced traffic management system (ATMS) software training on simulator with two hour focus periods, and/or a four year engineering degree.
- 2 years experience on-the-job with advanced traveler information systems (ATIS) or in TOC or broadcast media work environment, dispatch center, or similar facility, or four year education.

ADDITIONAL EDUCATION AND EXPERIENCE DESIRED FOR FULLY-TRAINED TOC OPERATORS

- 2 years of job experience using a multi-channel business telephone set.
- Successful completion of courses of physical or earth science at $10^{th}$-grade level, combined with roadway weather information system (RWIS) vendor training in weather systems.
- Four year college degree in a technical or scientific field with a concentration in traffic engineering, or 10 years experience in traffic control with a government agency or traffic control equipment vendor.
- 2 years experience on-the-job with incident management in an emergency response, police, fire, service patrol, or military work environment, dispatch center, or similar facility. Alternatively, advanced EMT training or 4 year education with major coursework in transportation or emergency preparedness and response.
- Two year technical college degree in electronics, or four year college education in a technical or scientific field covering electronics, or four years of experience in a traffic surveillance, control, and data acquisition-type work environment where monitored points issue failure alarms, or two years prior experience in a TOC having automated failure management.