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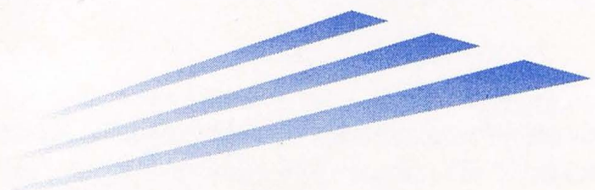
NIGHT-TIME CONSTRUCTION ISSUES



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Research Report
KTC-00-16

Night-Time Construction Issues

By

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Kentucky Transportation Center
College of Engineering
University of Kentucky

In cooperation with the Kentucky Transportation Cabinet

August 2000

Commonwealth of Kentucky
Transportation Cabinet
Frankfort, Kentucky 40622

James C. Codell, III
Secretary of Transportation

E. Jeffrey Mosley
Deputy Secretary

Paul E. Patton
Governor

September 14, 2000

Mr. Jose M. Sepulveda
Division Administrator
Federal Highway Administration
330 West Broadway
Frankfort, Kentucky 40602

Subject: Implementation Statement for Final Report entitled
"Night-Time Construction Issues"
Study Number; KYSPR 00-217

Dear Mr. Sepulveda:

The goal of this study was to provide the Kentucky Transportation Cabinet with a base of knowledge for determining when and how to successfully utilize night-time construction practices for its highway construction projects. This was accomplished by working closely with an experienced advisory committee of Cabinet construction personnel and Kentucky contractors.

Seventeen specific recommendations have been proposed to enhance the Cabinet's use of night-time construction for its projects. These cover several issues related to night-time work, including contract requirements, traffic control, law enforcement, personnel issues, lighting and public awareness. A method (the Night-Time Project Evaluation Form) was also developed for evaluating a proposed construction project as a candidate for night-time work.

Sincerely,

J. M. Yowell

J. M .Yowell, P.E.
State Highway Engineer

c: John Carr
Paul Toussaint
Dexter Newman
Cliff Linkes

EDUCATION PAYS

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
KTC-00-16		

4. Title and Subtitle	5. Report Date
Night-Time Construction Issues (KYSPR 00-217)	July 2000
	6. Performing Organization Code
7. Author(s): Donn Hancher and Timothy Taylor	8. Performing Organization Report No. KTC 00-16
9. Performing Organization Name and Address Kentucky Transportation Center College of Engineering University of Kentucky Lexington, Kentucky 40506-0281	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. KYSPR 00-217
12. Sponsoring Agency Name and Address Kentucky Transportation Cabinet State Office Building Frankfort, Kentucky 40622	13. Type of Report and Period Covered Final
	14. Sponsoring Agency Code

15. Supplementary Notes

Prepared in cooperation with the Kentucky Transportation Cabinet and the U.S. Department of Transportation, Federal Highway Administration

16. Abstract

This report addresses several issues to consider when considering performing highway construction work in Kentucky at night. Surveys of other state departments of transportation and Kentucky highway contractors were made to identify best practices and concerns. An advisory committee of experienced KyTC engineers plus contractor representatives met extensively to identify successful approaches for handling key issues which arise on night-time construction projects.

Seventeen specific recommendations have been proposed to enhance the Cabinet's use of night-time construction for its projects. These cover several issues related to night-time work, including contract requirements, traffic control, law enforcement, personnel issues, lighting and public awareness. A method (the Night-Time Project Evaluation Form) was also developed for evaluating a proposed construction project as a candidate for night-time work.

If properly implemented, night-time construction can greatly decrease the duration of highway construction projects, greatly reduce road user delays and associated costs, while providing a safe environment for both workers and the traveling public.

17. Key Words	18. Distribution Statement
Night-time, construction, contracts, traffic safety, traffic control	Unlimited with approval of the Kentucky Transportation Cabinet

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	120	

NIGHT-TIME CONSTRUCTION OPERATIONS

Report

Appendices

Chapter 1: Introduction

There is an increasing demand for performing transportation-related construction and maintenance operations at night, especially in urban areas, to reduce conflicts with the traveling public. This approach can be beneficial for reducing traffic disruptions; however, there are several concerns to the highway departments and contractors which must be considered.

Generally there is a perceived loss of productivity associated with night work which can increase the cost of highway construction projects. Night work can also be hazardous to both construction workers and the traveling public. There are also liability concerns for the safety of the traveling public and increased citizen complaints near night-time projects. Because of these, and many other factors, better guidelines are needed for utilizing night work for KyTC construction projects.

1.1 Background and Significance of Work

Several DOTs have found that it is more advantageous to perform highway construction work at night, especially in urban areas. The primary advantage is the avoidance of serious disruptions to day-time traffic. However, there are several problems associated with night work, such as: safety of motorists, safety of construction workers, citizen complaints of excessive noise, perceived loss of productivity, and increased demands on highway personnel. Kentucky is considering performing more highway construction projects and this research will better prepare the Cabinet to successfully implement practices for night-time construction for selected types of projects.

The researchers sought to: (1) provide a rational system for determining when night- time construction for KyTC projects is feasible; (2) provide a basis for determining the cost and schedule impact of utilizing night-time construction; (3) determine the KyTC personnel requirements for night-time construction projects; and (4) identify possible specification changes and public awareness programs needed to optimize the potential benefits of night-time construction.

1.2 Goals and Objectives of the Study

The goal of this study was to provide the Kentucky Transportation Cabinet with a knowledge base for determining when and how to successfully utilize night-time construction practices for highway construction projects. The following objectives were identified to attain this goal:

1. Identify the results of utilizing night-time construction on past KyTC construction projects and on projects performed by other DOTs.

2. Seek input from Kentucky highway contractors on the utilization of night-time construction on KyTC projects and recommendations for improving the current process.

3. Identify the potential advantages and disadvantages of utilizing night-time construction practices for KyTC projects, and changes needed to improve current practices.

4. Develop recommendations for the successful implementation of night-time construction practices for KyTC projects, including the primary project characteristics required, plus possible personnel, specifications and public awareness requirements.

Chapter 2: Research Accomplishments

The research team used various methods to gather information concerning night-time construction. First, a literature review was conducted to determine what research had already been performed in the area. Next, a research advisory committee was formed to review the work of the researchers and give input through the course of the project. Finally, a survey was used to gain the insight of night-time construction practitioners. This chapter discusses each of the research methods.

2.1 Literature Review

The research team conducted a comprehensive review of published literature, research project reports, and specifications from other DOTs on the topic. The results of the review are summarized to provide a comprehensive understanding of the topic and provide a basis for this study. The team found that existing research concerning night-time construction mainly focused on the following areas:

- Identifying factors affecting night-time construction
- Evaluating night-time vs. day-time construction
- Illumination for night-time construction
- Traffic control for night-time construction
- Quality and safety issues regarding night-time construction
- Increasing public awareness of night-time construction
- Abatement of night-time construction noise, vibration and other nuisances

In addition two very informative reports by "The Last Resource, Inc." dealing with several aspects of night-time construction are due to be published in the summer of 2000 by the National Cooperative Highway Research Program (NCHRP), *A Procedure for Assessing, and Planning Night-Time Highway Construction and Maintenance*; and *Guidelines for Design and Operation of Night-Time Traffic Control for Highway Maintenance and Construction.*

2.1.1 Identifying Factors Affecting Night-Time Construction

Based on the literature review, a number of factors have been identified that affect the decision to perform highway construction operations at night. The following is a list of these factors:

- *Traffic-Related Factors*
  - Congestion
  - Safety
  - Traffic Control
- *Construction-Related Factors*
  - Cost
  - Quality
  - Schedule
  - Productivity
- *Social Factors*
  - Conditions for Workers
  - Conditions for Drivers
  - Community Concerns
- *Economic Factors*
  - User Costs
  - Business Losses
  - Construction and Maintenance Costs
  - Accident Costs
- *Environmental Factors*
  - Fuel Consumption
  - Noise
  - Lighting
  - Vibration
- *Other Factors*
  - Public Relations
  - Supply and Service Availability
  - Supervision and Communication

2.1.2 Evaluating Night-Time versus Day-Time Construction

The majority of the literature advocates night-time construction as an effective means to minimize traffic congestion, maximize operational efficiency in the work-zone, as well as helping to protect the environment by limiting the number of cars idling in traffic due to lane closures. George E. Pataki, Governor of New York State, reported in

1998, that "night-time construction is a common-sense initiative that makes life a little easier for New York taxpayers"(NYDOT, 1998).

However, critics express concerns over greater safety hazards, interruption to night-time traffic flow, and cost increases compared to day-time operations. Issues involved include safety hazards to workers and drivers, increased project costs, inexperience of the agency and contractors in performing night work, potential negative effects on quality, noise, light pollution, and material supply problems.

On methods for evaluating night-time construction against day-time construction, several were proposed such as an eight-step method (Elrahman and Perry, 1998), and a quantitative weighted rating method (New York DOT, EI 96-027).

2.1.3 Illumination for Night-Time Construction

Illumination is considered an important issue in night-time construction. Literature concerning this topic focused on two major points:

1. To provide sufficient lighting arrangements to protect the quality of production and the safety of workers.
2. To reduce glare to passing travelers and nuisance to residents.

Several DOTs specify lighting levels for different types of projects while others do not. OSHA has established a minimum lighting requirement for night work (OSHA Regulations, Standards-29 CFR) and some researchers have conducted comprehensive studies on lighting and provided detailed information on lighting level requirements and lighting equipment selection.

Glare is defined as the "presence within the human visual field of very brightly illuminated areas that degrade visual performance" (Ernzen and Schexnayder, 1999). To reduce glare to passing motorists, light fixtures should meet established requirements of

location, height, and direction before operations begin. Screening devices such as shields, visors, or louvers are also recommended. When the project is located near residential areas, cares should be taken to avoid disturbing the community.

2.1.4 Traffic Control for Night-Time Construction

New York has developed detailed specifications for traffic control plans for night-time construction (New York DOT, EI 95-003). Connecticut also requires contractors to provide a traffic control plan for night-time construction activities (Connecticut DOT). In a report by *The Last Resource, Inc.*, traffic issues in night-time construction were well illustrated. According to the report the following traffic issues need to be addressed by contractors and the agency for night-time construction projects:

- Road Closure/Detour
- Lane and Shoulder Closure
- Ramp Control
- Channeling and Guiding Devices
- Warning Signs and Message Signs
- Flagging Operations
- Other Traffic Requirements

2.1.5 Quality and Safety Issues in Night-Time Construction

Little is mentioned in current literature about the relationship between product quality and night-time construction. However, some DOTs do undertake special quality-related measures such as the adaptation of operation procedures to night-time conditions or lighting requirements.

Proper lighting and traffic control arrangements are necessary for the safe implementation of night-time construction. Other special safety devices, such as warning lights on vehicles, high visibility apparel, and hard hats are recommended by most states.

2.1.6 Public Awareness of Night-Time Construction

Nearly all of the current literature deemed public awareness activities extremely important for night operations. Informing the public of the location, schedule, and duration of highway work as well as alternate travel routes will reduce the negative effects of night-time construction on traffic flow. Establishing a good community relations program through public awareness and understanding also reduces the negative public perception of highway construction.

According to several sources, during the planning phase of night-time projects, possible nuisances should be identified and made known to the local government and community leaders. Obtaining feedback from those impacted by night work is recommended as well as several other techniques to increase public awareness (Ernzen and Schexnayder, 1999):

- Special Signage
- Personal Contacts
- Special Mailings
- Press Releases
- Internet Web Site

2.1.7 Abatement of Night-Time Construction Noise, Vibration, and Other Nuisances

A thorough research of night-time construction noise, vibration, and other nuisances was carried out by NCHRP (National Cooperative Highway Research Program) in Synthesis 218. According to the recommendations of the research, these nuisances can be mitigated by applying special devices to the construction site and increasing public awareness.

Some state departments, such as Connecticut, developed technical provisions to address noise and vibration issues during night-time operations (Connecticut DOT).

2.2 Survey of Night-Time Construction Practices

In order to determine the issues and problems associated with night-time construction a survey was conducted among the State Departments of Transportation, selected Kentucky highway contractors, and the Kentucky Transportation Cabinet Resident Engineers. The three groups received a similar survey, copies of which are included in Appendix A. Detailed results of the survey are included in Appendix B.

The survey sought to determine the issues that contributed to the decision to work at night, what problems had been encountered during night work, what effect night work has on project schedule, cost, and safety, and how night work affected the quality and productivity of certain construction activities. Additionally the groups were asked what they felt was the biggest advantage and disadvantage of performing work at night.

Of the surveys that were mailed, responses were received from 32 State Transportation Departments, 20 Kentucky highway contractors, and 23 Kentucky Resident Engineers

2.2.1 Factors Leading to Night-Time Construction

Figures 2.1, 2.2, and 2.3 represent the results of the survey question: *Which of the following heavily contribute to your decision to work at night?* From the charts it is apparent that high daytime traffic levels heavily influence the decision to work at night, generating the greatest number of responses from each group. Following that the three survey groups slightly differed in their opinions, as shown in Table 2.1.

Figure 2.1: Issues Contributing to the Decision to Work at Night (DOT)

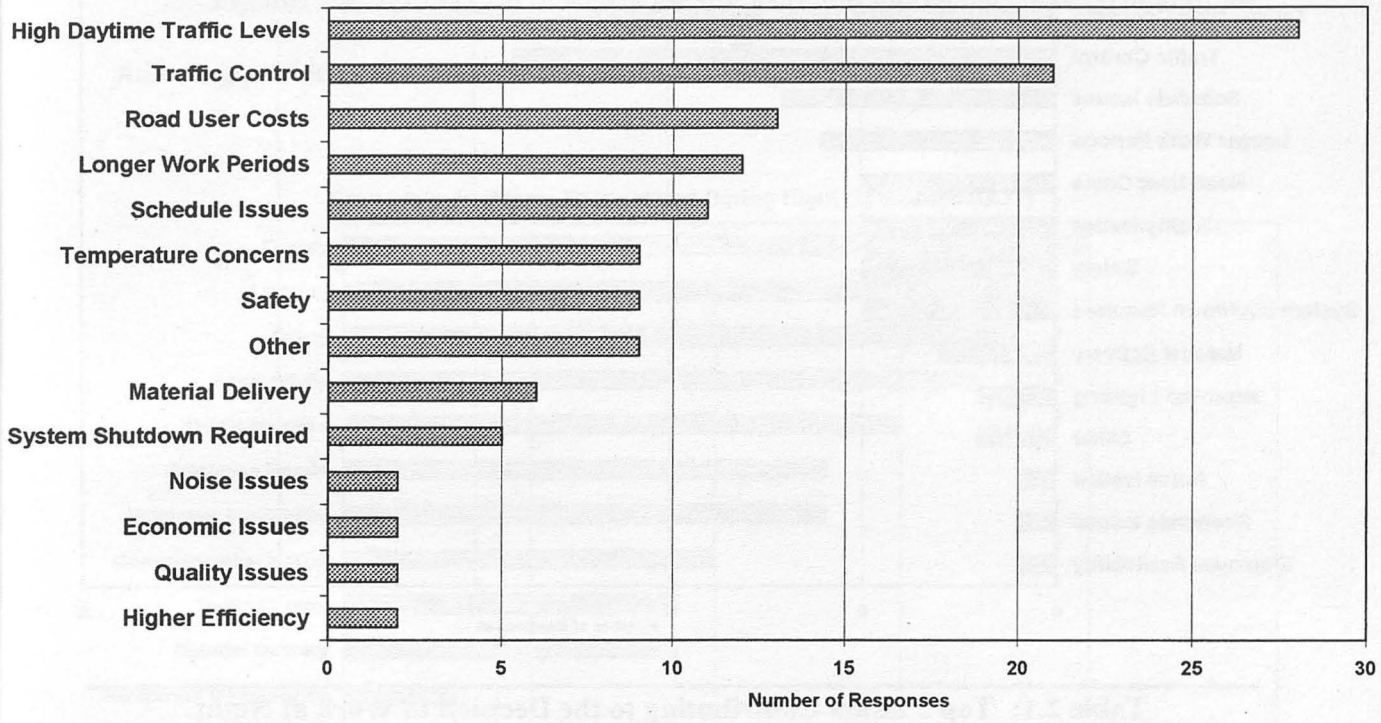


Figure 2.2: Issues Contributing to the Decision to Work at Night (Contractor)

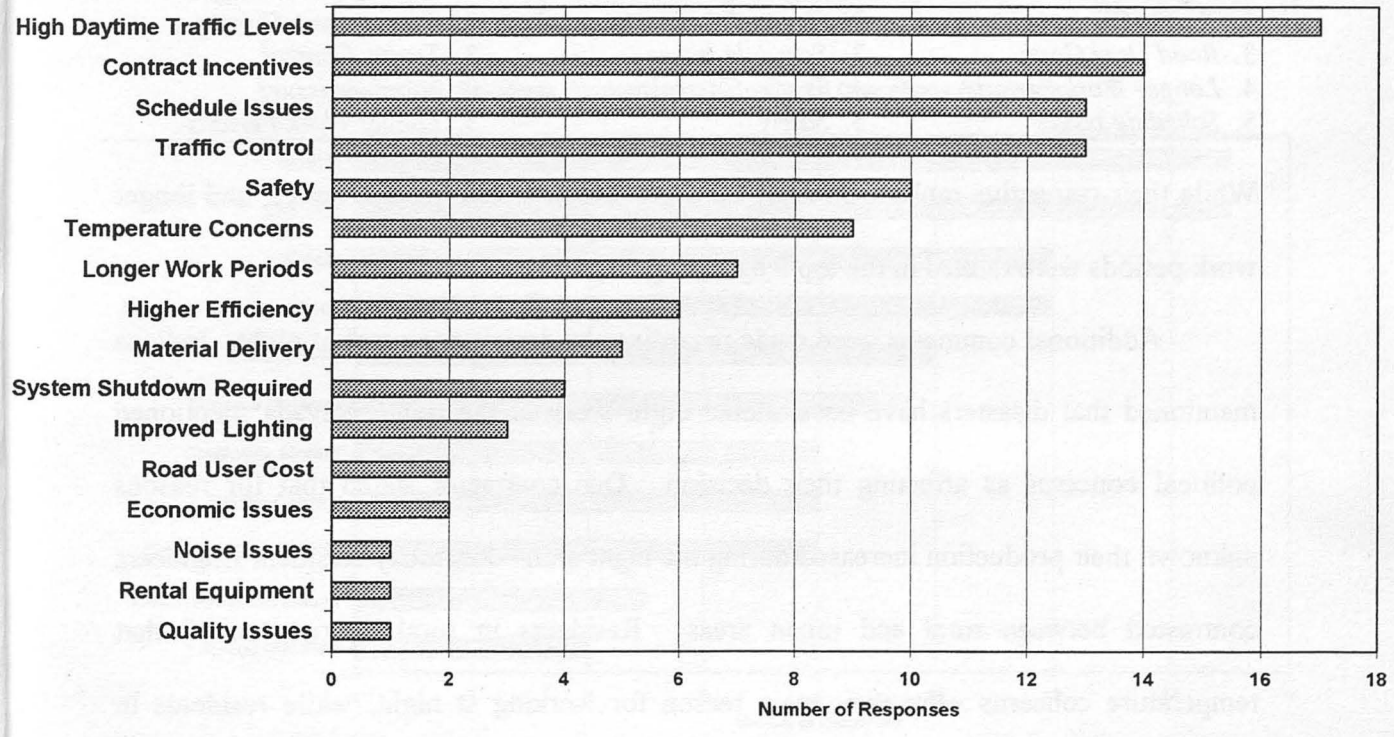


Figure 2.3: Issues Contributing to the Decision to Work at Night (Resident Engineer)

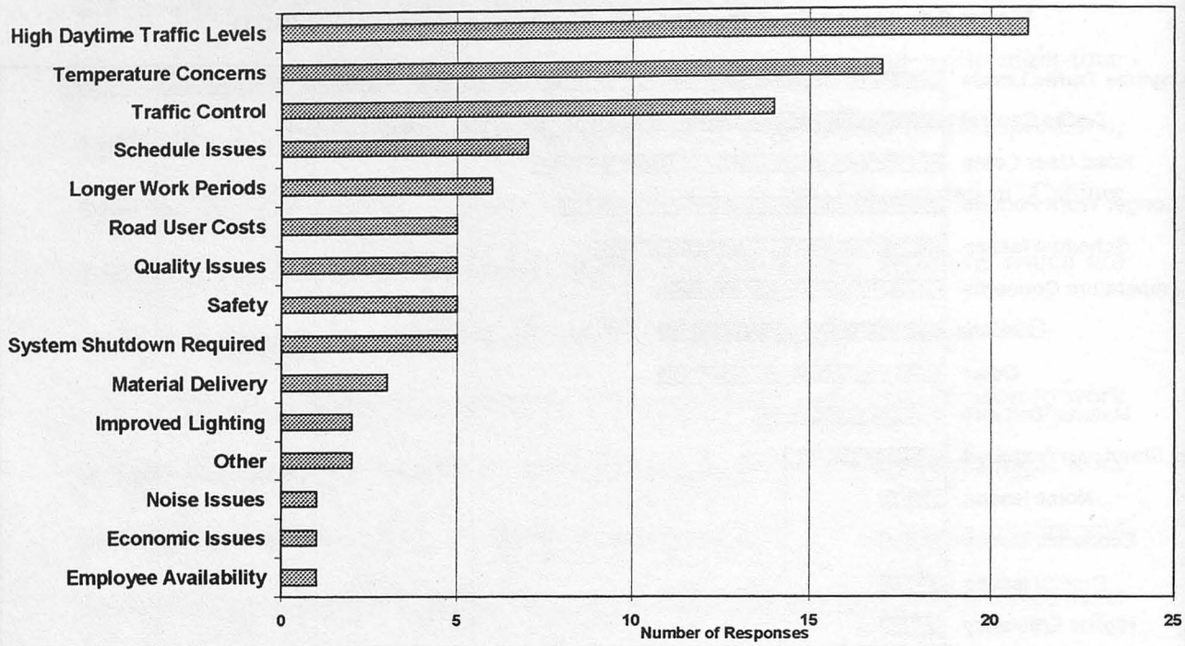


Table 2.1: Top 5 Issues Contributing to the Decision to Work at Night

Dept. of Transportation	Highway Contractor	KyTC Resident Engineer
1. *High Daytime Traffic*	1. *High Daytime Traffic*	1. *High Daytime Traffic*
2. *Traffic Control*	2. *Contract Incentives*	2. *Temperature Concerns*
3. *Road User Costs*	3. *Schedule Issues*	3. *Traffic Control*
4. *Longer Work Periods*	4. *Traffic Control*	4. *Schedule Issues*
5. *Schedule Issues*	5. *Safety*	5. *Longer Work Periods*

While their respective ranks may vary, schedule issues, traffic control issues, and longer work periods were ranked in the top 5 by each group.

Additional comments were made regarding the decision to work at night. Indiana mentioned that disasters have necessitated night work in the past. Nevada mentioned political concerns as affecting their decision. One contractor stated that for reasons unknown their production increased during the night shift. Kentucky Resident Engineers contrasted between rural and urban areas. Residents in rural districts stated that temperature concerns were their main reason for working at night, while residents in urban areas stated that daytime traffic levels were their main concern.

2.2.2 Problems Encountered During Night Operations

Figures 2.4, 2.5, and 2.6 represent the results of the survey question: *Which of the following problems have you encountered during night operations?*

Figure 2.4: Problems Encountered During Night Operations (DOT)

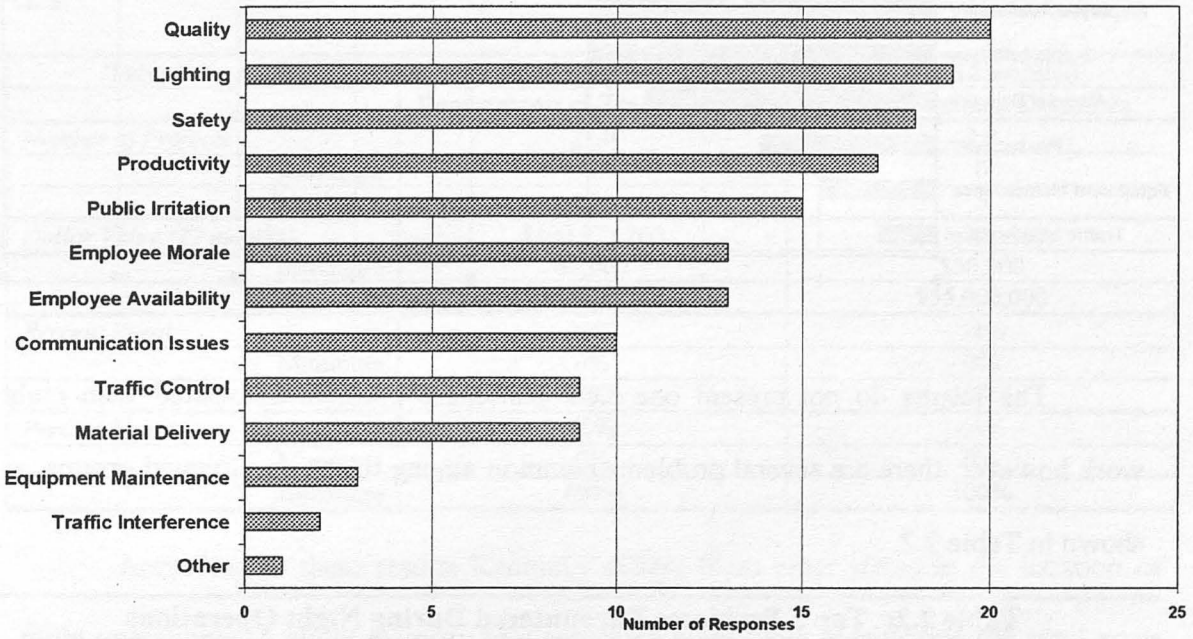


Figure 2.5: Problems Encountered During Night Operations (Contractor)

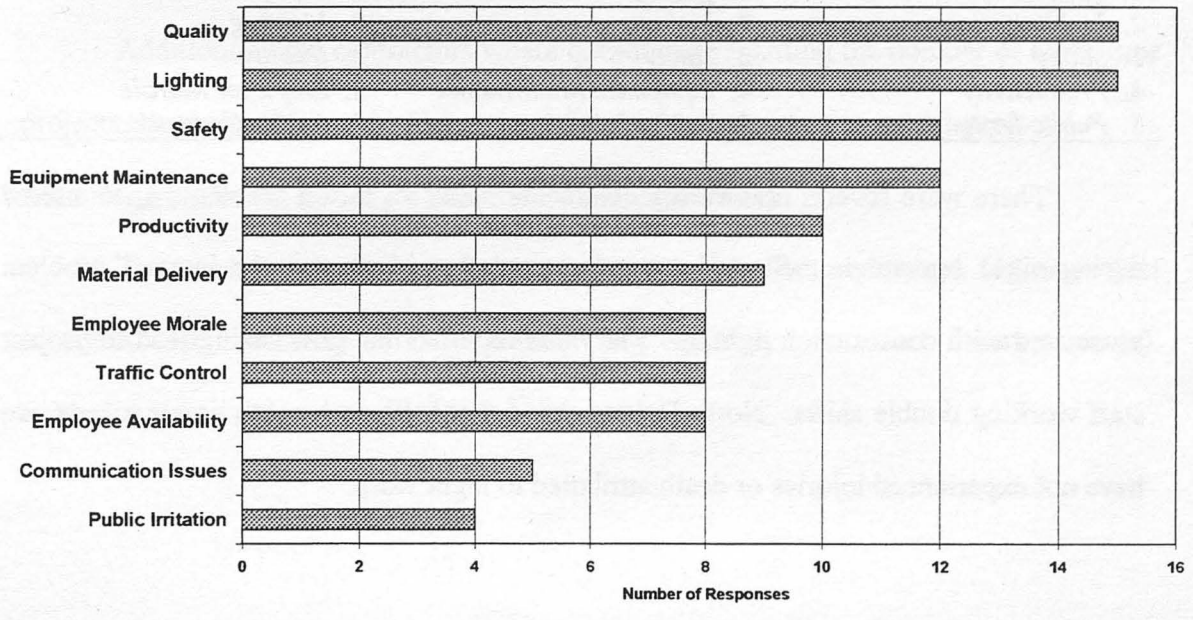
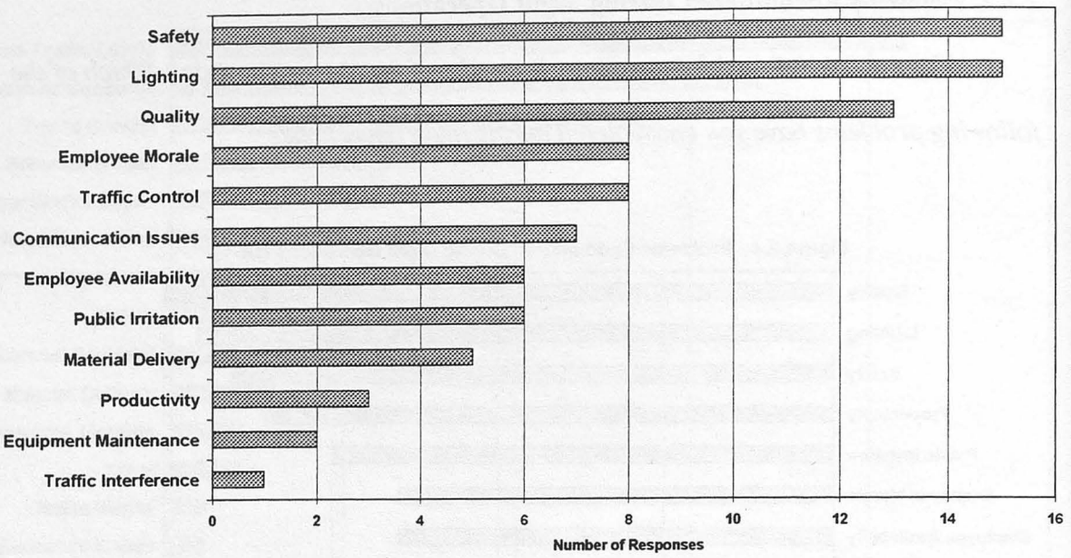


Figure 2.6: Problems Encountered During Night Operations (Resident Engineer)



The results do not present one clear consensus problem associated with night work however, there are several problems common among the three surveyed groups, as shown in Table 2.2.

Table 2.2: Top 5 Problems Encountered During Night Operations

Dept. of Transportation	Highway Contractor	KyTC Resident Engineer
1. *Quality*	1. *Quality*	1. *Safety*
2. *Lighting*	2. *Lighting*	2. *Lighting*
3. *Safety*	3. *Safety*	3. *Quality*
4. *Productivity*	4. *Equipment Maintenance*	4. *Employee Morale*
5. *Public Irritation*	5. *Productivity*	5. *Traffic Control*

There were several noteworthy comments made regarding problems encountered during night operations. Several states reported that glare was the biggest problem associated with construction lighting. Maryland reported that downsizing lead to project staff working double shifts. North Dakota stated that "although safety is a concern, we have not experienced injuries or death attributed to night work."

2.2.3 Night-Work Performed over the past 12 months

The State Departments of Transportation and the Kentucky Resident Engineers were asked for information regarding the volume, value, and location of night work in their state or district over the last 12 months. Statistical information is shown in Table 2.3.

Table 2.3: Average Volume, Value, and Location of Night Work (Previous 12 months)		
	Departments of Transportation	**KyTC Resident Engineers**
Number of Projects	23.0	2.2
Minimum	1	0
Maximum	150	5
Dollar Value (12 months)	$100,973,205	$14,026,857
Minimum	$2,000	$50,000
Maximum	$400,000,000	$55,000,000
Percent Rural	20%	54%
Minimum	0%	0%
Maximum	100%	100%
Percent Urban	80%	46%
Minimum	0%	0%
Maximum	100%	100%

According to these results Kentucky differs from other states in the location of night operations. A slight majority of Kentucky's night work is performed in rural areas where as other states perform the majority of their work in urban settings.

Additionally the contractors where questioned regarding the number of night-time projects they had performed. The average for the 20 contractors was 14.1 projects.

2.2.4 Night Work's Effect on Schedule, Cost, and Safety

The three surveyed groups were asked to rate the effect night work had on project schedule, cost, and safety on a 1-5 scale (1-very negative, 3-no effect, 5-very positive). Table 2.4 shows the average values for each group.

Table 2.4: Night Work's effect on Schedule, Cost, and Safety			
	Departments of Transportation	Highway Contractors	Resident Engineers
Schedule	3.8	3.7	3.9
Cost	2.5	2.8	3.2
Safety	2.8	2.9	3.0

What is surprising in these results is that project safety, commonly perceived as being compromised at night, was rated as not affected by the three groups. A possible reason for this, as provided by comments from the respondents, was that at night, workers are more aware of the dangers and thus were more conscious of safety practices.

2.2.5 Special Work Rules for Night-Time Construction

The highway contractors were questioned regarding any special work rules that they applied to their labor force for night operations. Most contractors stressed that safety was emphasized for night operations however; only one of the 20 contractors reported to providing advanced training for night shift employees. Nearly all contractors stated that additional reflective clothing was worn at night. Several contractors also stated that they did not perform detailed finish work at night.

2.2.6 Night Work's Effect on Quality and Productivity

The commonly held belief is that the degree that quality and productivity are affected by night work varies from operation to operation. Certain operations can be performed better at night while other operations are negatively impacted. The three surveyed groups were asked to rate how night work affected the quality and productivity of the following activities on a 1-5 scale (1-very negative, 3-no effect, 5-very positive).

Earthwork
Bridge Deck Pour
Bridge Deck Overlay
Structural Bridge Work
Concrete Pavement
Asphalt Pavement
Blasting
Drainage/Utilities
Rock Excavation
Striping
Sign Placement
Traffic Control Systems

Figure 2.7: Night Work's Effect on Quality

Figure 2.7: Night Work's Effect on Quality

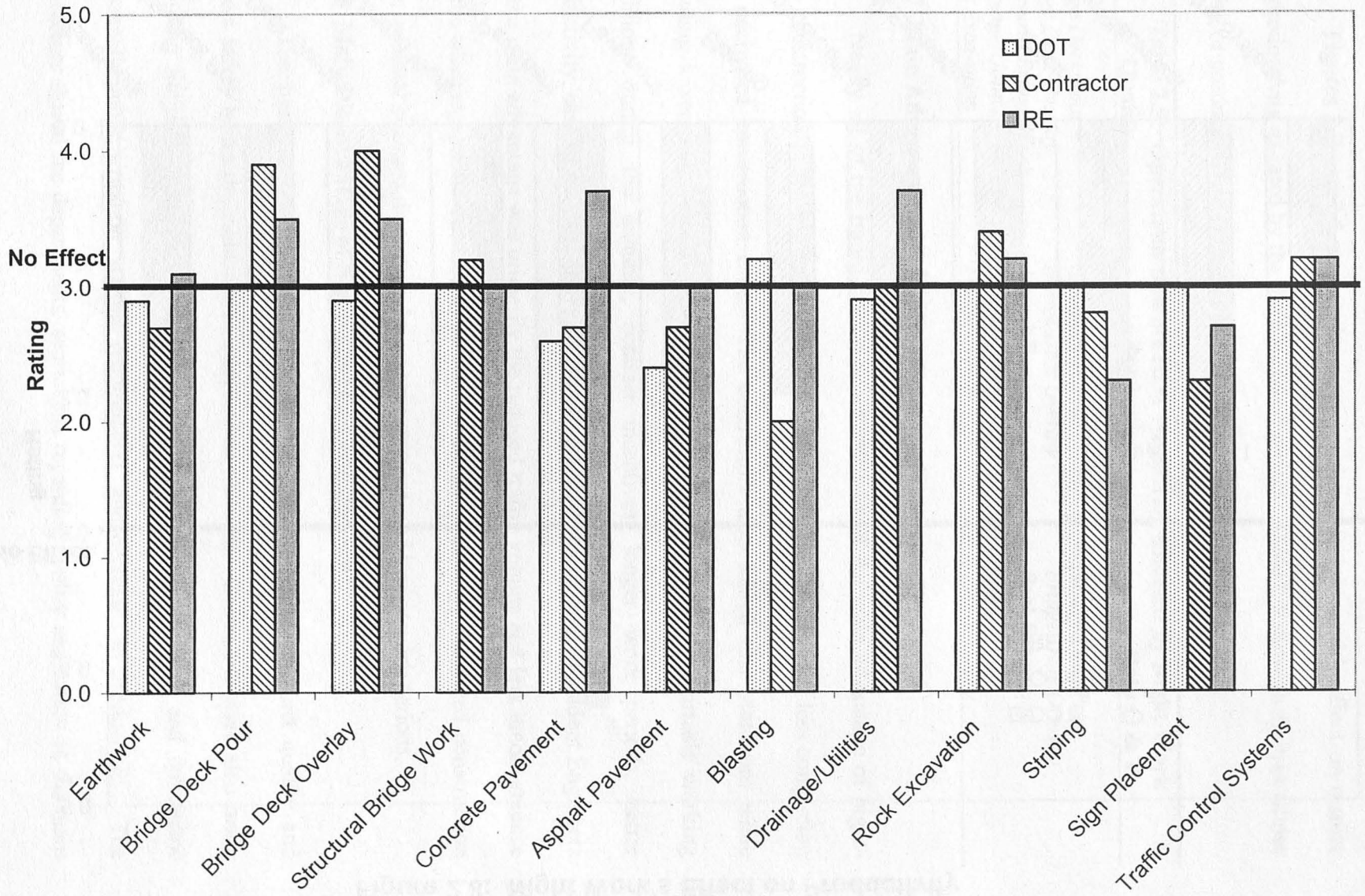
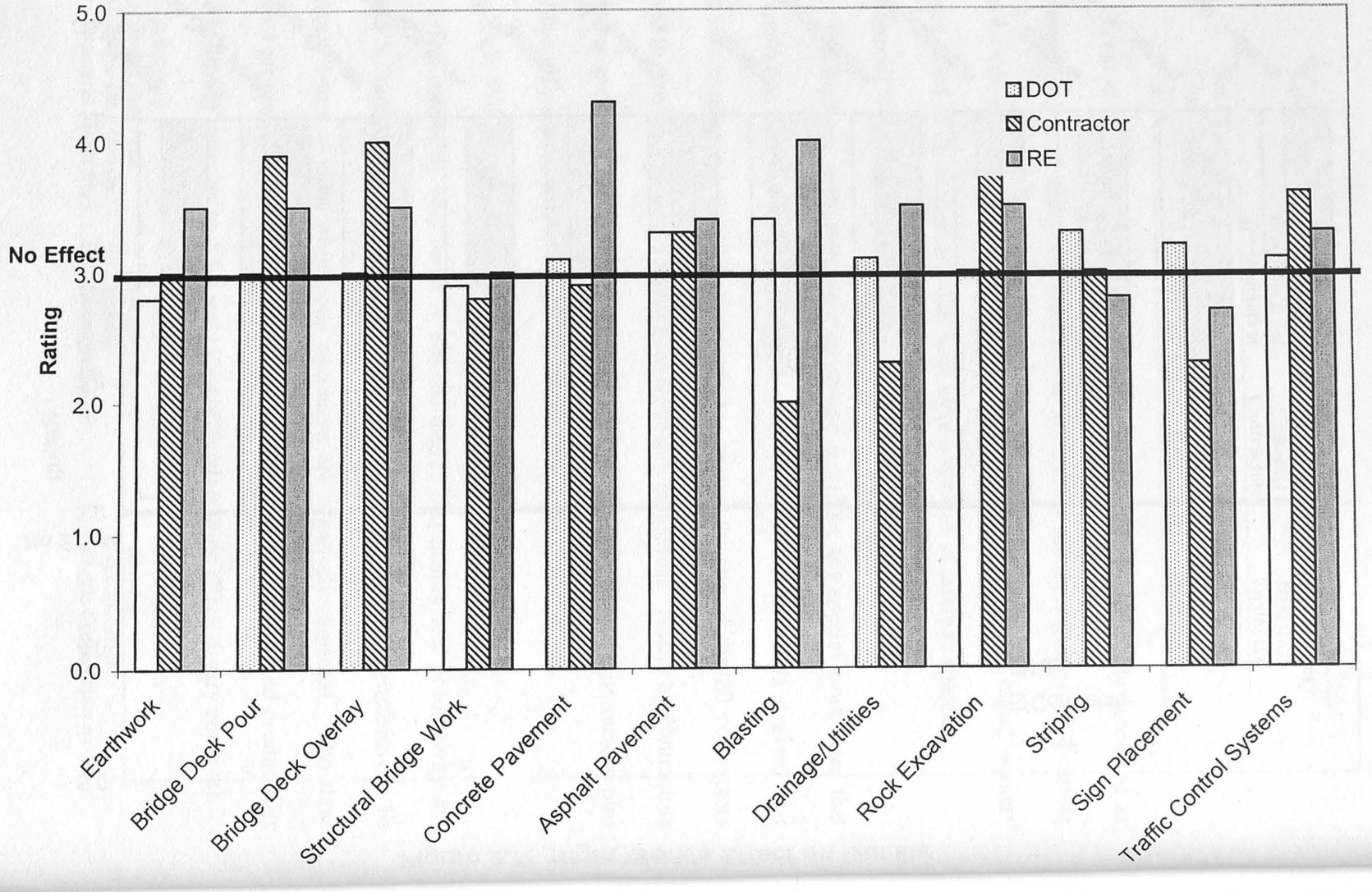


Figure 2.8: Night Work's Effect on Productivity



Figures 2.7 and 2.8 present the average values of night work's affect on quality and productivity as rated by the three surveyed groups. Table 2.5 shows activities whose quality or productivity or both are NOT negatively effected by night work.

Table 2.5: Operations that are NOT Negatively Effected by Night Work

Quality	Productivity	Both Q & P
Bridge Deck Pour	*Bridge Deck Pour*	*Bridge Deck Pour*
Bridge Deck Overlay	*Bridge Deck Overlay*	*Bridge Deck Overlay*
Structural Bridge Work	*Asphalt Pavement*	*Rock Excavation*
Drainage/Utilities	*Rock Excavation*	
Rock Excavation	*Traffic Control*	

2.2.7 Main Advantage of Night-Time Construction

Nearly all of the transportation departments listed the main advantage of night-time construction as the decreased impact on the traveling public through less congestion and decreased construction time. The contractors also shared this sentiment while including lower temperatures leading to better quality and more comfortable working conditions during the summer, contract incentives, longer work periods, better productivity, ease of material delivery, and reduced equipment costs. Resident Engineers felt the main advantage was primarily the reduced traffic volume and less inconvenience for the traveling public but also cited ease of material delivery, decreased construction time, minimal business disruption, lower temperatures, and longer work periods.

2.2.8 Main Disadvantage of Night-Time Construction

The transportation departments were evenly split between product quality and project safety being the main disadvantage of night work. Comments were also made regarding limited work hours, employee morale concerns (both DOT and contractor personnel), public irritation, staffing requirements, and decreases in productivity. The contractors shared the departments' sentiments regarding quality and safety as the main

disadvantage. They also cited local laws governing night work, public irritation, decision making difficulty, manpower shortages, workers morale, equipment repair, and poor visibility. One contractor stated that there were no disadvantages to night work. The resident engineers also cited quality and safety as their major concern. Also mentioned was public irritation, noise, visibility problems, KyTC personnel scheduling, decision making, and lighting.

2.2.9 Additional Comments

Several states provided additional comments on the subject of night-time construction. Arkansas stated that "alcohol impaired drivers are more numerous at night." Georgia has been utilizing night work for several years but does not have special specifications or requirements for night operations. Nevada stated that "success is contractor/project specific." Texas recommended only using night work when day work was not feasible

The highway contractors also included additional comments. One comment stated that rough grading could easily be accomplished at night while final grading was nearly impossible. Another contractor predicted that most striping will eventually be done at night. Several contractors stated that the success of night work depended upon several factors including location, project type, and traffic considerations. One contractor stated that worker availability problems could be reduced by maintaining constant and uniform night operations. Another contractor commented on lane closures stating, "We could open more lanes sooner if we were allowed to use temporary safety features (barrels, cones, etc.) before [the] guardrail is installed."

Comments from resident engineers covered a broad range of topics. One reported that with no added pay incentives most employees would prefer to not work at night. Another stated, "I feel we should be very selective in the work performed at night due to the premiums paid for the work and the inferior workmanship." Educating the public was listed as a necessity by one Resident.

2.2.10 Summary of Survey Results

The survey results both upheld and disproved some common perceptions of night-time construction. Safety, while commonly perceived as being compromised at night, was rated as not affected by the three surveyed groups despite repeatedly being cited as one of the primary disadvantages of night work. The belief that the main reason for utilizing night work was high daytime traffic levels was upheld while the commonly perceived negative impact on quality and productivity was disputed. According to the survey the cost of night work is generally higher than similar day time construction activities. Overall the results seem to indicate that the success or failure of night work varies depending upon the type of work being performed, the experience of the contractor with night work, and the location of the project.

2.3 Night-Time Construction Research Advisory Committee

In order to aid the research team in studying night-time construction an advisory committee including both state employees and contractors was assembled. This committee gave the researchers areas of importance to focus their efforts on as well as reviewing all work done by the research team. The research advisory committee provided the researchers valuable insight into the real world issues affecting night-time construction.

The research advisory committee was composed of the following members.

Rocky Adams *Judy Construction*	Jim Morris *The Allen Company*
James Ballinger *Kentucky Transportation Cabinet*	James Stallard *Kentucky Transportation Cabinet*
*Donn Hancher *University of Kentucky*	Larry Stolz *Kentucky Transportation Cabinet*
David Hunsucker *Kentucky Transportation Center*	*Tim Taylor *University of Kentucky*
Carl Jenkins *Kentucky Transportation Cabinet*	*Ray Werkmeister *University of Kentucky*
Bob Lewis *Kentucky Transportation Cabinet*	*Yuhong Wang *University of Kentucky*

*UK Research Team

The committee met several times for approximately three hours each throughout the duration of the project. Major topics discussed at these meetings included:

- Review of Survey Questionnaire
- Personnel Issues
- Review of Project Evaluation Form
- Night Operations Plan
- Night-Time Safety Training
- Review of Survey Results
- Advantages/Disadvantages of Night Operations
- Specification Recommendations
- Public Awareness Activities
- Development of Factors Effecting Night Operations

The Research Advisory Committee also reviewed the draft final report and provided input for it and the final recommendations.

Chapter 3: Night-Time Project Selection

One of the major objectives of the research project was to identify project characteristics that are conducive to night work. The following sections discuss the factors that affect night-time construction and a method for evaluating the potential of the project for night-time construction.

3.1 Factors Affecting Night-Time Construction

In order to accurately access the potential of a project for night-time operations it is important to identify the issues and parameters that affect night work. Figure 3.1 shows the parameters and issues that effect night work. This chart was based on a report by O. A. Elrahman and R. J. Perry in their 1997 paper *Guidelines for Night-Time Maintenance and Construction Operations*. The chart was expanded by the project's Advisory Committee to reflect issues that are relevant in Kentucky. Following is a description of each factor.

Traffic Related Parameters

Safety: The safety of the traveling public should be a leading factor in the decision to work at night. Traffic control and as well as construction methodology should be undertaken in a way that minimizes the risk associated with traveling through the work zone.

Congestion: The impact of the proposed construction on the traffic flow through the site.

Traffic Control: Traffic control affects both safety and congestion. Ellis and Herbsman in their 1993 report *Developing Procedures for Night Operations of Transportation Construction Projects* describe the two main goals of traffic control as:

1. To "ensure the smooth, safe movement of the traveling public through the work zone."
2. To "provide safety for the workers and equipment in the work zone" (1993).

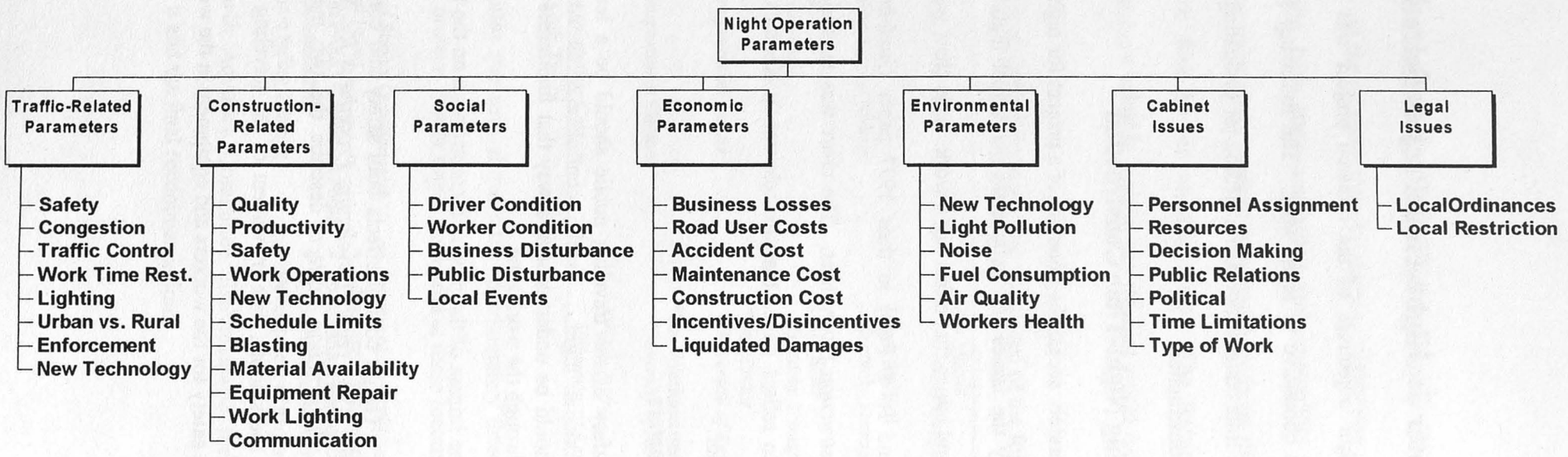


Figure 3.1: Factors Affecting Night-Time Construction

Work Time Restriction: Any operating hour restrictions that have been placed on the project through local, state, and federal agencies as well as contract restrictions.

Lighting: Construction lighting must be arranged in a manner that minimizes glare to the traveling public while still adequately illuminating the job site.

Urban vs. Rural: Typically rural areas have decreased traffic volumes moving at higher speeds compared to slower moving, dense urban traffic.

Enforcement: Traffic control and construction speed limits must be enforced in order to be effective. This is generally achieved through local or state police departments.

New Technology: Signage, message boards, channeling devices, etc. that are more conducive to night-time construction.

Construction Related Parameters

Quality: The effect night work will have on the quality of the final product.

Productivity: The effect night work will have on the productivity of the contractor.

Safety: The safety of the workers is a key issue affecting the decision to work at night. Methodologies employed for night operations may differ from identical daytime operations for safety reasons.

Work Operations: Whether night-time conditions require different procedures or methodologies than daytime operations.

New Technology: The effect improved equipment and methodologies can have on night operations.

Schedule Limits: Restrictive schedule limitations. Possibility of decreasing completion time through double shift work.

Blasting: Careful considerations should be made concerning blasting operations at night.

Material Availability: Arrangements for the delivery of materials to the job site. Also added expenses for night-time material production and delivery may be incurred.

Equipment Repair: Contingency plans for dealing with the breakdown of major pieces of equipment should be developed. Key issues to consider are parts acquisition and the availability of back-up equipment.

Work Lighting: Lighting can affect nearly every aspect of night work.

Communication: During night operations communication between field and office personnel will be difficult.

Social Parameters

Driver Condition: Drivers at night are more likely to be fatigued or under the influence of drugs or alcohol.

Worker Condition: Workers are more likely to be fatigued at night. Figure 3.2 from Ellis and Herbsman's 1993 report *Developing Procedures for Night Operations of Transportation Construction Projects* shows factors affecting the ability of workers to cope with shift work.

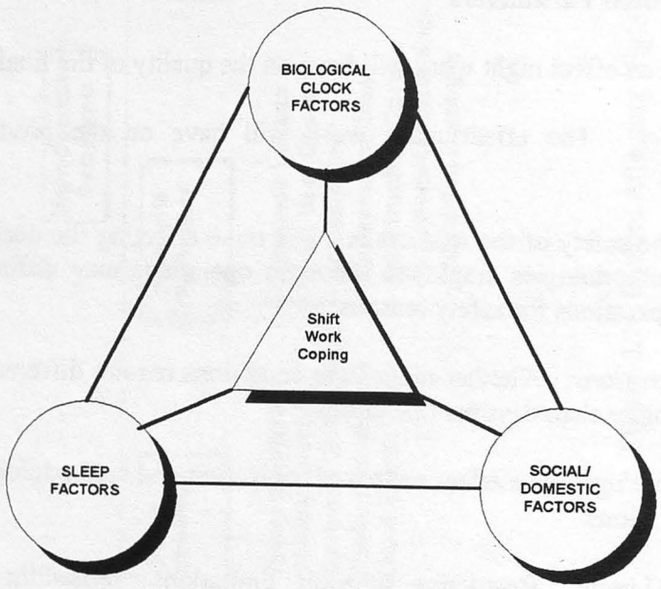


Figure 3.2: Shift Work Coping Factors (Ellis and Herbsman, 1993)

Business Disturbance: The effect (noise, traffic, dust, etc.) that night operations will have on surrounding businesses.

Public Disturbance: The effect (noise, traffic, dust, lighting, etc.) that night operations will have on the surrounding residential areas.

Local Events: The presence of local community events (church functions, sporting events, concerts, etc.). If necessary, work may have to be suspended during the function.

Economic Parameters

Business Losses: The economic impact on surrounding business due to inaccessibility and construction interference. The impact on trucking and shipping industries should also be considered.

Road User Cost: The road user cost should be calculated for the area of the project. Day vs. Night-time costs should be compared.

Accident Costs: The costs associated with motorist accident and their impact, both financial and traffic wise, on the project and surrounding community.

Maintenance Costs: Costs associated with equipment maintenance activities to be performed. Generally considered to be increased for equipment being operated at night.

Construction Cost: The contract price of the project.

Incentives/Disincentives: Incentives for night work or early completion. Disincentives for late finish or extensive traffic delays.

Liquidated Damages: Financial losses resulting from the late completion of the project.

Environmental Parameters

New Technology: Equipment or methodologies that reduce the environmental impact of night-time construction including improved mufflers, reduced idling time, etc.

Lighting Pollution: Excessive illumination caused by over-lighting a site. Nuisance to surrounding communities.

Noise: Tables 3.1 and 3.2 from a 1999 report by James Ernzen and Cliff Schexnayder entitled *Mitigation of Nighttime Construction Noise, Vibration, and Other Nuisances* give examples of common noise generators and activities.

Table 3.1: Common Noise Generators

Noise Generator	Percent Identifying Activity as Cause of Problems*
Back-up Alarms	41%
Slamming Tailgates	27%
Hoe Rams	24%
Milling/Grinding Machines	16%
Earthmoving Equipment	14%
Crushers	6%

Table 3.2: Activities That Cause Nighttime Noise Problems

Activity Type	Percent Identifying Activity as Cause of Problems*
Pavement Breaking	27%
Paving/Resurfacing	25%
Pile Driving	24%
Bridge Deck Removal	24%
Rehab	20%
Patching	12%
Earthmoving	2%
Crushing	2%

* As rated by the 50 State DOTs

Fuel Consumption: Generally at night less fuel is burned through idling cars in gridlock situations.

Air Quality: Pollution from automotive exhaust emissions could be lessened by reducing gridlock situations.

Worker's Health: Health issues arising from the inhalation of automotive exhaust fumes.

Cabinet Issues

Personnel Assignment: Selecting the personnel to work at night based upon employee satisfaction, family disruptions, supervisory problems, etc.

Resources: The ability of the Cabinet to staff and operate both day and night operations.

Decision Making: The ability of on site field personnel to make decisions regarding the project.

Public Relations: Activities undertaken to inform the public about the nature of the work, why it is being performed at night, what delays are expected, and the availability of alternate routes.

Political: Political reasons behind the decision to work at night.

Time Limitations: Employee work hour limitations.

Type of Work: Activities which the state has deemed unacceptable for night work or activities in which the state encourages night work.

Legal Issues

Local Ordinances: Legal policies or rules established by the local government regarding the performance of construction work at night.

Local Restrictions: Restrictions imposed by non-governmental organizations such unions, materials suppliers, etc.

3.2 Night-Time Project Evaluation Form

In order to evaluate the potential of a specific project for night-time construction a project evaluation form has been developed. This form's questions are divided among categories that address traffic issues, economic issues, social issues, construction issues, and other issues of a project. The questions quantify the effect night work will have on a project through the use of a 1-5 scale (1-Very Negative, 3-No Effect, 5-Very Positive). After completing the form the evaluator will than weight the categories according to their relative importance on the particular project.

It is important to note that this form "*does not*" indicate the decision regarding whether to work at night. The form, if nothing else, forces the construction planner to consider the issues that will affect performing the project at night. The ultimate decision lies with the construction planner.

A sample of the proposed night-time project evaluation form and a description of the use of the form will be discussed in this section of the report. An example project is shown in section 3.3 and is included in Appendix C.

3.2.1 Sample Night-Time Project Evaluation Form

KyTC
Night-Time Construction
Project Evaluation Form

Project: _____ Project No.: _____ District: _____

Form Completed By: _____

Position/Title: _____ Date: _____

Traffic Issues

Based upon a recent traffic analysis, what is the current *level of service* of the site during the day?

A	B	C	D	E	F	
0	1	2	3	4	5	_____

Based upon a recent traffic analysis, what would be the estimated *level of service* after a daytime lane closure?

A	B	C	D	E	F	
0	1	2	3	4	5	_____

Based upon a recent traffic analysis, what is the current *level of service* of the site during night-time?

F	E	D	C	B	A	
0	1	2	3	4	5	_____

Based upon a recent traffic analysis, what would be the estimated *level of service* after a night-time lane closure?

F	E	D	C	B	A	
0	1	2	3	4	5	_____

Traffic Issues Average: _____

Economic Issues

How will local businesses be impacted by day-work?

Low Impact		Moderate Impact		High Impact	
1	2	3	4	5	_____

How will local businesses be impacted by night-work?

High Impact		Moderate Impact		Low Impact	
1	2	3	4	5	_____

What is the estimated daytime road user cost of the construction site?

Low		Medium		High	
1	2	3	4	5	_____

Economic Issues Average: _____

Social Issues

What is the location (radius) of residential development (including churches, hospitals, etc.) in relation to the job site?

< ¼ mile	¼ - ½ mile	½ -1 mile	1-2 miles	> 2 miles	
1	2	3	4	5	_____

How will this development be affected by the following during night operations:

Lighting

Very Negative		Moderate		Low	
1	2	3	4	5	_____

Noise

Very Negative		Moderate		Low	
1	2	3	4	5	_____

Vibration

Very Negative		Moderate		Low	
1	2	3	4	5	_____

Traffic

Very Negative		Moderate		Low	
1	2	3	4	5	_____

Social Issues Average: _____

Construction Issues

How would performing this project at night affect:

Quality

Very Negative		No Effect		Very Positive	
1	2	3	4	5	_____

Schedule

Very Negative		No Effect		Very Positive	
1	2	3	4	5	_____

Cost

Very Negative		No Effect		Very Positive	
1	2	3	4	5	_____

Safety

Very Negative		No Effect		Very Positive	
1	2	3	4	5	_____

Construction Issues Average: _____

Other Issues

Are there any other operations, conditions, or special events that could affect the feasibility of night operations?

Very Negative		No Effect		Very Positive
1	2	3	4	5

Description

_____ _____

_____ _____

_____ _____

_____ _____

Other Issues Average: _____

Issues	Weight*	Rating	Weighted Rating
Traffic Issues			
Economic Issues			
Social Issues			
Construction Issues			
Other Issues			

100%

ΣTotal Weighted Rating: _____

Scale

4-5 Definite Candidate for Night-Time Construction

3-4 Good Candidate for Night-Time Construction

2-3 Marginal Candidate for Night-Time Construction

1-2 Poor Candidate for Night-Time Construction

*The standard weight for each category should be 20% unless the evaluator deems other weights more appropriate.

3.2.2 Explanation of Night-Time Project Evaluation Form

Traffic Issues

The questions pertaining to the traffic-related portion of the form are evaluated on the basis of the *level of service*. The level of service analysis allows the evaluator to judge the effect lane closures or other construction activities has on the traffic flow through the construction zone regardless of the size of the road.

The level of service is determined from the mean passenger car speed and the flow rate in passenger cars per hour per lane (pcphpl). Once these values are determined and adjusted for various factors, the level of service is found using the chart taken from the Highway Capacity Manual shown in Figure 3.3.

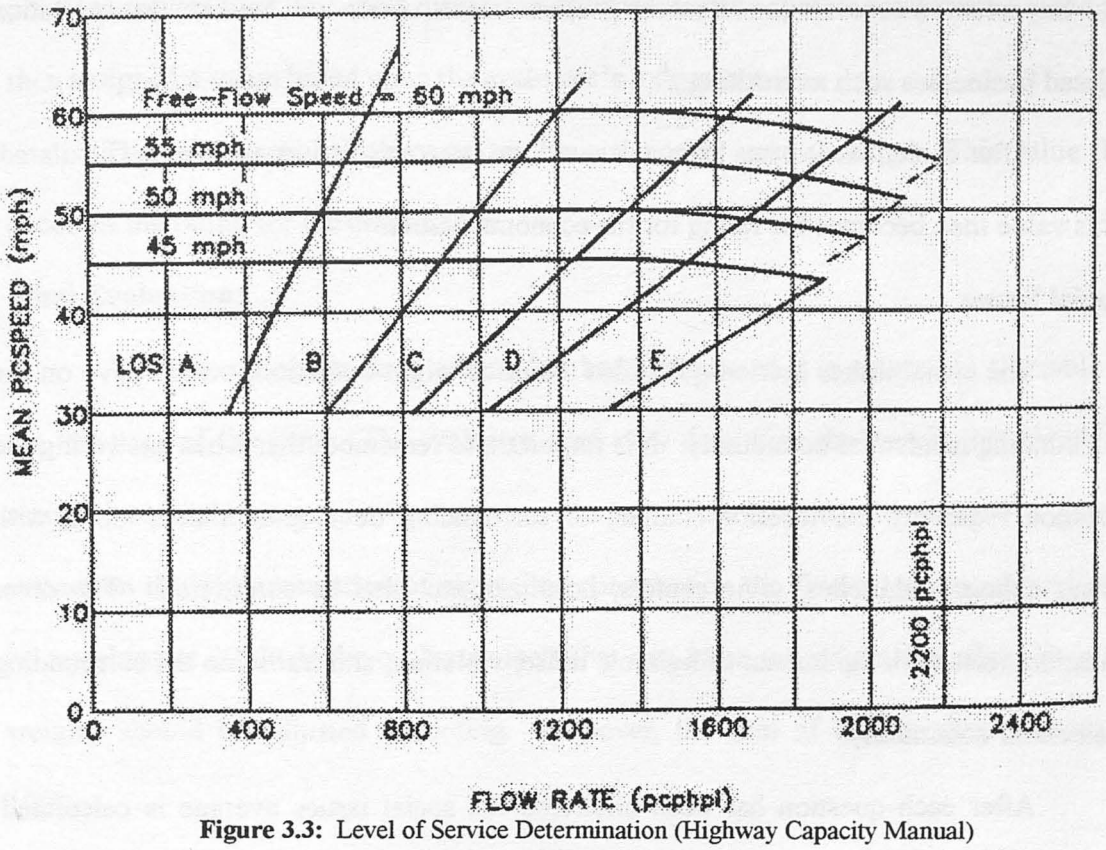


Figure 3.3: Level of Service Determination (Highway Capacity Manual)

The level of service during normal daytime traffic, daytime construction, normal night-time traffic, night-time construction is compared.

After each question has been answered the traffic issues average is calculated. This value then becomes the rating for the traffic issues.

Economic Issues

The economic portion of the evaluation estimates the financial impact night-time construction will have on the surrounding business community. As this is difficult to quantify the evaluator will have to use his or her best judgement. If the surrounding area is largely office space, night-time construction will have a low impact on the area. Areas of high impact could contain restaurants, nightclubs, shopping centers, and any other business whose primary operating hours fall outside the 8:00AM-6:00PM range. It is

also important to consider the effect the proposed construction will have on transportation related businesses such as trucking.

After each question has been answered the economic issues average is calculated. This value then becomes the rating for the economic issues.

Social Issues

The social issues section quantifies the effect night operations would have on the surrounding residential community. It is important to remember that when answering the question regarding the location (radius) of surrounding development that, along with living quarters, churches, civic centers, hospitals, etc. also be considered. The other question deals with the impact of lighting, noise, vibration, and traffic on the surrounding residential community.

After each question has been answered the social issues average is calculated. This value then becomes the rating for the social issues.

Construction Issues

This section evaluates the effect night work would have on quality, schedule, cost, and safety in relation to the project. After each question has been answered the construction issues average is calculated. This value then becomes the rating for the construction issues.

Other Issues

This section allows the evaluator to include any important condition, operations, or special events that were not accounted for in the other sections. Examples could include, but are not limited to, any of the following: nightly church services, high volume sporting events, construction operations that are better performed at night,

political implications, and local restriction/ordinances. The special condition is listed and then assigned a value based upon the evaluator's judgement.

The values are then averaged to obtain the other issues average. This value then becomes the rating for the other issues.

Final Evaluation

After the rating for each section has been calculated it is entered in the table on the last page of the form. The evaluator must now determine the weight that should be assigned to each category. Unless one or more issues are deemed to have a greater impact on the implementation of night-time construction the five categories should each be weighted at 20%. If the evaluator feels that one issue outweighs the others then the weights should be adjusted according. However, the sum of the weights must equal 100%.

After the appropriate weights have been assigned the weighted rating is calculated by multiplying the unweighted rating by the assigned weight. The weighted ratings are then summed to calculate the total weighted rating. This values is then compared to the given scale to determine the feasibility, based upon this analysis, of performing the project at night. The scale is as follows:

4-5 Definite Candidate for Night-Time Construction

3-4 Good Candidate for Night-Time Construction

2-3 Marginal Candidate for Night-Time Construction

1-2 Poor Candidate for Night-Time Construction

Again, it is important to remember that this evaluation form is merely a tool in the decision making process. The ultimate decision regarding night work should be made by the construction planner after carefully evaluating the situation.

3.2.3 Example Project

The following is a worked example of a fictitious project. Its function is to illustrate the use of the night-time project evaluation form. It does not reflect an actual project.

KyTC
Night-Time Construction
Project Evaluation Form

Project: Route 123 Project No.: 1 District: 7

Form Completed By: Joe Engineer

Position/Title: Chief Engineer Date: 5/31/00

Traffic Issues

Based upon a recent traffic analysis, what is the current *level of service* of the site during the day?

A	B	C	D	(E)	F	
0	1	2	3	4	5	4

Based upon a recent traffic analysis, what would be the estimated *level of service* after a daytime lane closure?

A	B	(C)	D	E	F	
0	1	2	3	4	5	2

Based upon a recent traffic analysis, what is the current *level of service* of the site during night-time?

F	E	D	C	B	(A)	
0	1	2	3	4	5	5

Based upon a recent traffic analysis, what would be the estimated *level of service* after a night-time lane closure?

F	E	D	(C)	B	A	
0	1	2	3	4	5	3

Traffic Issues Average: 3.5

Project: Route 123

Economic Issues

How will local businesses be impacted by day-work?

Low Impact		Moderate Impact		High Impact	
1	2	3	**(4)**	5	4

How will local businesses be impacted by night-work?

High Impact		Moderate Impact		Low Impact	
1	2	3	4	**(5)**	5

What is the estimated daytime road user cost of the construction site?

Low		Medium		High	
1	**(2)**	3	4	5	2

Economic Issues Average: 3.7

Social Issues

What is the location (radius) of residential development (including churches, hospitals, etc.) in relation to the job site?

< ¼ mile	¼ - ½ mile	½ -1 mile	1-2 miles	> 2 miles	
(1)	2	3	4	5	1

How will this development be affected by the following during night operations:

Lighting

Very Negative		Moderate		Low	
1	2	3	**(4)**	5	4

Noise

Very Negative		Moderate		Low	
(1)	2	3	4	5	1

Vibration

Very Negative		Moderate		Low	
1	**(2)**	3	4	5	2

Traffic

Very Negative		Moderate		Low	
1	2	**(3)**	4	5	3

Social Issues Average: 2.7

Project: Route 123

Construction Issues

How would performing this project at night affect:

Quality

Very Negative		No Effect		Very Positive	
1	2	**(3)**	4	5	3

Schedule

Very Negative		No Effect		Very Positive	
1	2	3	**(4)**	5	4

Cost

Very Negative		No Effect		Very Positive	
1	**(2)**	3	4	5	2

Safety

Very Negative		No Effect		Very Positive	
1	**(2)**	3	4	5	2

Construction Issues Average: 2.75

Other Issues

Are there any other operations, conditions, or special events that could affect the feasibility of night operations?

Very Negative		No Effect		Very Positive
1	2	3	4	5

Description

Barrier Wall Placement	5
Local Football Stadium (High School)	2

Other Issues Average: 3.5

Project: Route 123

Issues	Weight*	Rating	Weighted Rating
Traffic Issues	20%	3.5	0.7
Economic Issues	20%	3.7	0.74
Social Issues	20%	2.2	0.44
Construction Issues	25%	2.75	0.69
Other Issues	15%	3.5	0.525
	100%		

ΣTotal Weighted Rating: 3.10

Scale

4-5 Definite Candidate for Night-Time Construction

3-4 (Good Candidate for Night-Time Construction)

2-3 Marginal Candidate for Night-Time Construction

1-2 Poor Candidate for Night-Time Construction

*The standard weight for each category should be 20% unless the evaluator deems other weights more appropriate.

Based upon the outcome of this evaluation the project would be a good candidate for night-time operations. However, the rating of 3.1 is just about the cut-off for a marginal candidate so the evaluator would have to carefully consider the decision to work at night.

Chapter 4: Specification Recommendations

State Departments of Transportation specifications for night-time construction range from no requirements to extensive requirements. The Research Advisory Committee, after reviewing the matter, felt that the current KyTC specifications would be adequate for night-time construction with only minor modifications. New lighting technology should be utilized to reduce the harmful effects of glare on workers and motorists. Additionally a Night-Time Construction Work Plan should be submitted for approval by the contractor prior to the execution of night-work.

4.1 Lighting Recommendations

As lighting affects nearly every aspect of night work the types of lighting permitted for night operations should be considered carefully. While traditional lighting may be adequate for operations that take place away from the traveling public, special considerations should be made for activities that take place on or near the roadway. The key concern in this area is the reduction of glare to both workers and on-coming traffic.

A new lighting technology now being used by several highway contractors that greatly reduces the harmful effects of glare while providing ample site illumination is the Airstar Balloon Light manufactured by Airstar, Inc. The light uses an outer balloon to diffuse glare from the light source. At this time it is the feeling of the research team that the new lighting system should be studied further and eventually be specified as the approved light source to be used in areas where normal lights cause safety hazards with the workers and the traveling public.

4.2 Night-Time Construction Work Plan

The Night-Time Construction Work Plan is a method to ensure that all special considerations that must be made to successfully implement night-time construction have been undertaken. The plan, if nothing else, will require the contractor to think about special considerations concerning night-time construction. The contractor shall develop a plan for night-time construction activities and submit the plan to the State at the pre-construction meeting. Night work should not begin until the plan has been approved and implemented. Based on current research on night-time construction (The Last Resource Inc., 1999), work plan specifications from other DOTs (New York and Connecticut) and inputs from KyTC and contractor personnel, the plan can include, but is not limited to, the following elements:

Lighting Plan

- Layout of light towers
- Description of lighting equipment
- Electrical power source details
- Other relevant information

Traffic Control Plan

- Layout of road and lane closures
- Ramp control details
- Channeling and guiding devices
- Location and text of variable message boards

Special Safety Considerations

- Equipment warning devices
- Personnel protective clothing
- Overhead power lines

Emergency and Contingency Plan

- Contingency plan(s) for anticipated emergencies
- Local emergency contacts
- Local utility contacts
- Motorist accidents and breakdowns

Other Elements

- Abatement of construction noise and vibrations
- Materials/Supply/Equipment Availability

To reflect any change in work conditions, the plan should be revised and updated by the contractor, according to the instruction of engineers, during the progress of the project.

4.3 Guidelines for Night-time Construction Plan

The following is a brief description of each element of the plan. It is important to remember that these are only suggestions. The nature of the project may dictate the need for more or less information.

4.3.1 Lighting Plan

The illumination plan should provide the elements necessary for a safe and productive job site, including adequate illumination for construction in work areas and facilitating quality control and inspection. The plan should indicate the location and output of lighting fixtures. The contractor should arrange lighting elements appropriately so that adequate illumination levels can be achieved throughout the work area while eliminating shadows and avoiding the impediment of on-coming traffic. Although their performance and efficiency may vary, various light sources can be used for work zone illumination such as incandescent tungsten halogen, mercury vapor, metal halide, high-pressure sodium. Headlights, as well as road lights, should not be used as the sole means of illumination. The contractor shall give clear indication of the types of luminaries and their wattage in the plan. As in keeping with the recommendations of section 4.1 non-glare lighting must be used in areas where lighting can interfere with vehicular traffic. The plan should also indicate the power source for the light plants.

Several states set lighting level requirements (Ellis, Herbsman, and Kumar) and the Occupational Safety and Health Administration (OSHA) also specifies minimum lighting levels for construction and related areas (OSHA Regulations, Standards-29 CFR). The agency and contractor should discuss appropriate lighting levels based on project requirements in pre-construction meetings. Table 4.1 shows common illuminace levels for night-time construction activities.

Table 4.1: Illuminance Levels for Night-Time Highway Work (Ellis-Herbsman, 1995)

Category	Minimum Illuminance Level*	Application	Examples of Activities to be Illuminated
I	5 fc	Large size visual task Low accuracy General safety requirement	Excavation Sweeping and cleanup Movement of areas in the work zone Movement between two tasks
II	10 fc	Medium size visual task Low to medium contrast Medium accuracy Safety on and around equipment	Paving Milling Concrete work
III	20 fc	Small size visual task Low contrast High accuracy and fine finish	Crack filling Pot filling Work requiring extreme attention

* Measured in foot-candles

4.3.2 Traffic Control Plan

Generally, the main advantage of night-time construction is the reduced impact on heavy traffic loads, decreasing the time of delays during peak traffic hours. However, because lighting levels as well as driver alertness are also reduced, care must be taken in the design of traffic control throughout the construction site. In additional to compliance with the provisions of the Manual on Uniform Traffic Control Devices (MUTCD), and other standards and regulations, the traffic control plan should:

- "ensure the smooth, safe movement of the traveling public through the work zone."

- "provide safety for the workers and equipment in the work zone" (Ellis-Herbman, 1993).

Whenever feasibly possible, the complete detour of vehicular traffic from the roadway under construction should be considered. However, detours are only effective when drivers are well informed in advance. Descriptions of detour routes, advance signage details, description of barricades to be used, and safeguard measures should be included in the proposal of road closures.

When detours are unfeasible, separating night-time construction operations from public traffic by lane and shoulder closure should be utilized. The following elements should be considered in the layout of lane closures:

- Layout and type of traffic control devices
- Beginning and ending points of lane closure
- Work/traffic separation devices
- Warning signs and lights

Special considerations should be given to areas near entrance/exit ramps to ensure the safety of the traveling public:

- Decision to close ramps
- Channeling traffic to and from the ramp
- Advance warning and signage

Channeling devices and variable message boards should be laid out to attract the attention of the traveling motorists. The contractor should list the type, number, and size of these devices. For these devices to be effective they must be maintained in clean and working order. In addition when new routes are created through the construction zone, the striping of all previous lanes should be removed.

4.3.3 Overhead Power Lines and Other Special Safety Concerns

Due to the unique safety hazards associated with night work, special safety considerations should be made. To get the attention of workers and passing motorists, all equipment on the site should be equipped with warning lights, and all workers should wear safety clothing and hard hats with highly reflective strips.

Overhead power lines pose potential hazards to both day-time and night-time construction operations; however, reduced visibility at night can make it especially difficult for equipment operators to locate the lines. Increased humidity at night could increase the tendency for arcing between high-voltage electrical currents and construction equipment. Therefore, the work plan should show clearly the position and height of overhead power lines and what measures will be taken to avoid them. If possible the lines should be relocated or de-powered during construction operations.

Another important safety consideration is whether to allow night construction on the weekends due to the increase of impaired drivers on the road. This issue should be discussed between the contractor and state personnel. In areas of high weekend night-time traffic flow night operations should be avoided.

4.3.4 Emergencies and Contingencies

The contractors should identify possible emergency situations and contingency plans to be implemented in the event of an emergency. This should include the availability of alternate power sources in the event of a power outage, plans for the repair/replacement of key pieces of equipment in the event of a breakdown, and a procedure for handling motorist accidents in the work zone. Contact information should be included for local law enforcement, fire and ambulance, other emergency services, and

key contractor and state personnel for high-level decision making 24 hours a day. The contractor should provide other contingency information at the request of state personnel.

4.3.5 Other Elements

Depending upon the nature of the project information regarding noise or vibration producing activities and their mitigation should be provided. Special considerations should be made if the construction site is near a hospital or other highly sensitive institution. The method of noise or vibration abatement may include utilizing alternative construction methods, special sound reducing exhaust systems, the use of insulated sound barrier walls.

To avoid disruption of construction operation, the contractor should briefly explain the arrangements for major material supply and key equipment maintenance at night. This should include the name(s) of asphalt or concrete plants to be used during the project.

The contractor should provide any other information that state personnel deem necessary to provide a safe working environment.

Chapter 5: Personnel Issues

Night-time construction can have both positive and negative impacts on employees who work the night shift. Night work can allow free hours during the day-time, increased pay, and cooler temperatures in summer; however, it can also lead to increased worker fatigue and drowsiness. In response to the survey work described in Chapter 2, several contractors and transportation departments reported that their employees complained of having to work nights. Night-time construction can lead to safety problems, health problems, and interference with family and social interactions as well as other concerns. This section discusses the personnel issues inherit with night construction methods to alleviate its negative impact.

5.1 Benefits of Night-Time Construction to Employees

In other industries where night work is prevalent some employees feel there are many advantages to working nights including incentive pay and more available free time during the day. Several studies have indicated that in areas with high numbers of second shift jobs, such as areas with high factory employment, workers can adjust more easily to the rigors of night work. This is due to the fact that there are more opportunities for recreational and social activities during the daytime in these areas.

In the studied research and survey results, several contractors reported that during extreme summer temperatures, workers preferred night work because of reduced temperatures. Several others stated that workers felt safer at night because of reduced traffic volumes and the greater workspace achieved through increased lane closures.

As with any industry there are certain individuals who feel more comfortable working at night or who would prefer to not have to wake up early in the morning to come to work.

5.2 Negative Impacts of Night-Time Construction on Employees

While there are several positive implications of night-time construction, the majority of workers are negatively impacted by night work. These include problems associated with sleep, social and domestic issues, and the availability of required resources to staff night projects.

5.2.1 Sleep Issues

Research has shown that 20% of night shift workers in the U.S. suffer from some type of sleep disorder (Ellis-Herbsman 1993). Workers also complain about the quality of sleep they do receive. This leads to worker fatigue at the job site which not only affects productivity but also leads to safety issues. Operating heavy machinery and performing detailed inspection work requires a high level of concentration that can be compromised by inadequate rest.

Sleeping problems and disorders arise from the body's natural circadian rhythms or "biological clock." The body's normal routine is to rest at night while being active during the day. Figure 5.1 from Ellis and Herbsman's 1993 report *Developing Procedures for Night Operations of Transportation Construction Projects* shows how circadian rhythms, along with other factors affects the ability of the worker to cope with night work. This process can be reversed over several days where the body becomes accustomed to night work and functions normally. The problem with night-time

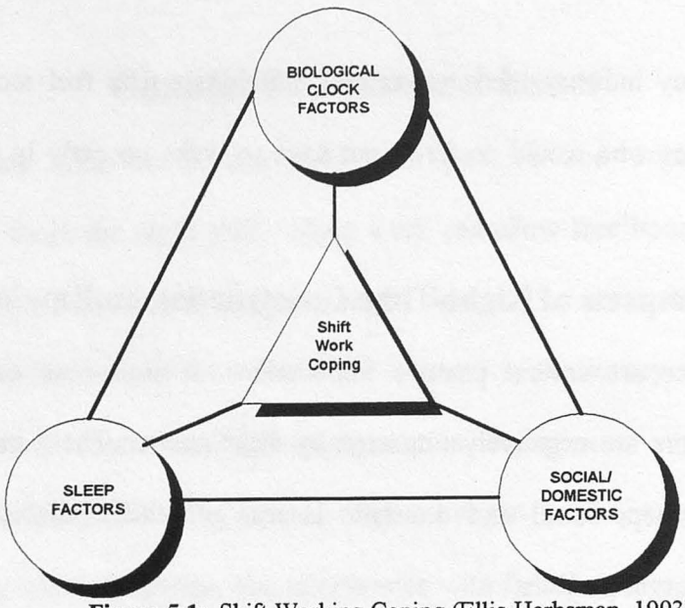


Figure 5.1: Shift Working Coping (Ellis-Herbsman, 1993)

construction in Kentucky is that, unlike major metropolitan areas where night work is ongoing, the work is sporadic. The workers may work the night shift for several days and then switch back to working during the day. This leads to the biological clock having to reset twice, which leads to increased fatigue.

5.2.2 Social and Domestic Issues

Night work, especially on weekends, can interfere with employees' social and family functions. Prolonged night work can put a strain on employees' relationships with their family. Night work can also prevent the worker from having time to socialize with friends and family due to conflicting schedules, leading to loneliness and isolation. These factors combine to cause further distraction on the job site that could cause safety hazards, loss of productivity, poor quality, and low work force morale.

5.2.3 Availability of Extra Resources

The KyTC has a limited number of employees and funding which makes staffing both day and night operations difficult. Work can only be handled by night shift assignment or through overtime. Many supervisors have to be available on a 24 hour call

basis as a result of night work since their day jobs must still take preferences. This leads to overworking and burnout of state employees both which negatively affects their performance on the job.

5.3 Mitigating Night Work's Impact on Personnel

While the negative effects of night-work on the work force cannot be eliminated their impact can be reduced. Current literature as well as discussions with the project research advisory committee offers several suggestions.

- *Establish Appropriate Schedules*

Employees appreciate a regular schedule for night work so they can better arrange their own personal activities. This can be achieved through (Rosa and Colligan, 1997):

  - Avoiding permanent (fixed or non-rotating) night shifts
  - Keeping consecutive night shifts to a minimum
  - Avoiding quick shift changes
  - Planning work free weekends
  - Keeping long work shifts and overtime to a minimum
  - Keeping schedules regular and predictable

- *Provide a Safe Working Environment*

This is achieved through providing employees with proper safety equipment (reflective clothing, hardhats, etc.), adequate protection from traffic, proper site illumination, and effective communication devices.

- *Night Work Training Programs*

Through education programs, KyTC employees can be trained on how to better perform their duties at night. They can also become familiar with lighting and traffic control requirements at night. In addition, the programs would help employee learn to deal with issues such as lack of sleep, stress, and other negatives associated with night work. For illustrative purposes these programs should be held at night.

- *Employee Health*

In addition to fatigue and drowsiness other health problems can be related to night work. For example, reduced viability compared to the daytime could result in vision problems. Some people may be less sensitive to dim light or lighting contrast than others; while some may be more susceptive to glare than others. Other health impacts at night include lack of motivation, moodiness, stomach problems, and lower vitality. It is important to carefully monitor the health of employees during night work.

Chapter 6: Public Awareness Activities

One key factor that can help alleviate certain problems associated with night-time construction is a well-organized public relations campaign. Keeping the public informed about the time, location, duration, and type of work serves two purposes. First, it lets the public know why the work is being done at night. If the public understands why night work was selected they will be more accepting of the associated problems. Second, informing the public regarding the location of the work will provide motorists the opportunity to select alternate routes, thus reducing congestion near the site. It will also prepare them for delays if alternate routes or times are not feasible.

6.1 Other States

There are several mediums that are currently being used by state transportation departments to dispense information regarding highway operations including (Last Resource, Inc., 1999):

- *Project/Highway Signage*
- *Local Newspapers*
- *Local Radio*
- *Telephone Hotlines*
- *Highway Advisory Radio (HAR)*
- *Local Television*
- *Internet Website*
- *Public Listserves*

In order to maximize the number of people reached it is recommended that a combination of media outlets be utilized. Regardless of the outlet, information should be as concise and current as feasibly possible to maintain the credibility of the medium (Last Resource, Inc., 1999).

In addition to providing information during construction operations, local officials and business leaders should be included in the planning process to represent the concerns of the surrounding community. This will provide planning officials insight into how night-time operations will impact the local community. It is also important to notify local

police and emergency agencies regarding planned night operations so they can adjust their routes accordingly.

6.2 Kentucky

The Transportation Cabinet currently uses all the above mentioned media for dispensing information regarding highway construction operations. Each media source provides varying levels of detail depending upon the size and type of project. Typically information pertaining only to large scale operations or operations that affect a sizable number of people are broadcast through local radio, television, and newspapers. Generally this broadcast will contain information regarding the work that is to be performed, any lane and/or ramp closures that are planned, estimated delays, and suggested alternate routes. Telephone hotlines and Highway Advisory Radio broadcasts (530AM) typically give detailed information for regional areas. Also several rest areas have been equipped with a computer kiosk showing road construction information.

The State's transportation web site (www.kytc.state.ky.us) provides traffic and construction information for the entire state. On the web site users have various options for obtaining information. They can subscribe to a listserve that reports monthly and special holiday construction updates via e-mail. Internet cameras show images from the Louisville metro area and will soon expand to Lexington and Northern Kentucky. The cameras are located at key road junctions to allow the public to monitor traffic conditions. The user can also access daily traffic reports and maps that detail construction operations and roadway conditions. In addition mass faxings are sent to truck stops, companies, emergency services, etc. to provide information regarding roadway closures and construction.

In heavily populated areas, such as Northern Kentucky, overhead variable message signs are being used to warn motorists of traffic conditions down the road. This provides motorists the opportunity to select an alternate route for their commute in the event of major delays.

6.3 Recommendations for Improvement

- Provide a listserve for the public that sends traffic and construction information everyday around 6:00AM (before morning commute) and 4:00PM (before evening commute). When the user registers for the service he/she can select from a list of roads and then only receive information regarding those roads. The mailing can detail planned construction activities (including land closures), estimated delays, and possible alternative routes. Information would be provided for day and night operations.

- Work with the contractor to ensure that when a lane is closed, work is being performed. If work is not on-going the lane should be open during non-construction hours. This reduces the public's perception that lanes are being closed without concern for traffic delays.

- Ensure that all information distributed through various media outlets is accurate. This maintains the creditablility of the outlet, otherwise the public will ignore broadcasted information. It is also essential that information updates are timely. For example, if the state's web page is to be updated at noon everyday adopt apprpriate measures to ensure its propmt and accurate update.

- Contact local emergency agencies (police, fire, medical) in advance of construction; the agencies should be invited to the pre-construction meeting. This allows the departments to adjust their emergy routes accordingly. This information should also be supplied to local trucking/shipping companies, churches, schools, and other special events that could be negatively impacted by night operations.

- During the planning phase of construction local government officals and buisness leaders should be invited to attend planning meetings. This will allow the planners insight into the local situation in order to determine how to minimize the impact of operations on the surrounding community.

- Message signs should be placed in the planned construction area in advance of construction operations to warn commuters about future construction.

Chapter 7: Summary and Recommendations

7.1 Summary

Night-time construction of transportation facilities is going to become more prevalent in the future. As the state begins to shift highway rehabilitation activities towards the evening hours care must be taken to ensure the safety of the workforce and motorists, and the quality of the final product. If properly implemented, night-time construction can greatly decrease the duration of road work projects, while providing a safe environment for both workers and the traveling public. There are several key elements of this report that must be addressed whenever night-time construction is being considered.

The factors that affect night-time construction, discussed in Section 3.1, must be considered during the construction planning phase. By understanding these factors the planner can better identify potential problems that could arise during the course of a project and plan their solution.

The *Night-Time Project Evaluation Form* discussed in Section 3.2, if properly implemented, could become a valuable tool in the planning of night-time construction projects. The form provides the planner a means of quantifying the above mentioned factors in a way that weighs each major factor to determine the feasibility of performing some or all of a project's work at night.

The major specification change presented is the Night-Time Construction Work Plan to be provided by the contractor. This plan will require the contractor to anticipate what equipment, lighting, methodologies, etc. to use on a project. It also allows the state

to view the contractor's construction plan and make any changes in the planning phase before the work has begun.

It is also important for the state to understand the added strain that night-work can put on cabinet employees. By understanding these concerns and taking measures to overcome them, employees will be more productive.

Finally, the importance of public awareness cannot be overstressed. By informing the public about the project specifics, and especially letting them know why the work is being done at night, their perception will be more positive. Kentucky has several mediums for dispersing information, but as with any process, there is always room for improvement.

7.2 Recommendations

Based upon current literature, the practices and policies of other transportation departments, and the advice and input of the research advisory committee, the following recommendations are offered in regards to night-time construction in Kentucky.

1. A detailed night-time work plan, as discussed in Section 4.2, should be required of the general contractor before night operations begin. This requirement should be included in the KyTC Construction Specifications.

2. Lane closures on highway construction projects should be limited to a maximum of 3 miles with at least a 5 mile buffer in-between consecutive closures to reduce the public's inconvenience and negative perceptions.

3. The use of police officers for enforcement of construction zone speed limits should be a contract pay item. Research and experience have shown that the use of law enforcement is the most effective means of reducing vehicle speeds through construction zones. The officers should also be clearly instructed of the reduced speed limits and when and where double fines may be issued.

4. Special signs should be erected in night-time construction work zones regarding *double fine* areas for traffic violations. The signs should have flashing lights mounted on top with the message *"Double Fines in Effect*

When Flashing." Double fines should only be issued when the lights are active.

5. Law enforcement patrolling the highway construction work zone should be reminded that there is a fine for intentionally moving a traffic control device ($50 fine per device).

6. The use of speed measuring/warning devices should be encouraged at the beginning of the construction zone for highway construction projects. The device should display and/or warn motorists when they exceed the posted construction speed limit.

7. To reduce travel speeds through night-time construction work areas, temporary thermal plastic speed bumps should be installed.

8. The general contractor on night-time construction projects should be required to have a full-time traffic control monitor to ensure that all traffic control devices are in good working order and are properly maintained.

9. The contractor and resident engineer should be vigilant for material deliverers that have exceeded their allowed daily drive time. Those found in violation of daily time limits should be reprimanded and ordered off the job.

10. The "chain of command" for night-time construction projects should be well organized and made clear to all supervisory personnel at the beginning of the project. A list of when, how, and whom to contact for key decisions should be readily available.

11. The *Night-Time Project Evaluation Form*, as discussed in Section 3.2, should be used during the initial planning phases to estimate the feasibility of performing all or part of the project at night.

12. A night-time construction training program for KyTC (required) and contractor (optional) personnel, as discussed in Section 5.3, should be implemented. For emphasis this program should be held at night.

13. The use of balloon lighting for night-time construction projects, as discussed in Section 4.1, should be further investigated.

14. All permanent and/or temporary roadway lighting to be constructed for a project should be erected as soon as feasibly possible to aid illumination during the night-time construction process.

15. In order to decrease construction time on critical Kentucky highway projects, contractors should be offered an incentive for 24 hour work schedules.

16. Public awareness activities for night-time construction projects, as discussed in Chapter 6, should be emphasized for all night-time projects prior to the start of construction.

17. Overtime exempt KyTC supervisory personnel should receive 1.5 compensatory time for all hours over 7.5 hours per day spent working on night-time construction projects from 8:00pm-6:00am.

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APPENDICES

APPENDIX A: Sample Survey Forms
- **A-1: Department of Transportation**
- **A-2: Kentucky Highway Contractor**
- **A-3: KyTC Resident Engineer**

APPENDIX B: Detailed Survey Results
- **B-1: Department of Transportation**
- **B-2: Kentucky Highway Contractor**
- **B-3: KyTC Resident Engineer**

APPENDIX C: Night-Time Project Evaluation Form

KYSPR-00-217

Night-time Construction Issues

STATE DOT QUESTIONNAIRE

PURPOSE OF THIS SURVEY

There is an increasing demand for performing many transportation construction and maintenance operations at night, especially in urban areas, to reduce the conflict with the traveling public. This approach can be beneficial for reducing traffic disruptions; however, there are several concerns to the Department of Highways and contractors which must be considered. There is a loss of productivity in doing work at night which may increase costs of the work and there is an increased risk for safety of the workers. There is also a major exposure for liability for the safety of the traveling public, and increased citizen complaints of noise near night-time project locations. Better guidelines are needed for utilizing night-time construction for KyTC construction projects.

Please complete the following request for information to aid in the processing of this survey:

State DOT: _____

Address: _____

_____

_____

City: _____ State: _____ Zip: _____

Questionnaire Completed By: _____

Position/Title: _____ Date: _____

Telephone: _____ Fax: _____

PLEASE RETURN QUESTIONNAIRE AND SUPPORTING INFORMATION BY: **11/22/99**

TO: Dr. Donn E. Hancher
161 Raymond Building
University of Kentucky
Lexington, KY 40506-0281

TEL: (606) 257-4857
FAX: (606) 257-4404
email: hancher@engr.uky.edu

THANK YOU FOR YOUR VALUABLE ASSISTANCE ON THIS PROJECT!!

PLEASE WRITE ON THE BACK OF ANY PAGES IF YOU NEED MORE SPACE FOR YOUR RESPONSES

1. Which of the following heavily contribute to your decision to work at night? (Check all that apply)

__ High Daytime Traffic Levels
__ Schedule Issues
__ Road User Costs
__ Temperature Concerns
__ Noise Issues
__ Rental Equipment
__ Economic Issues
__ Quality Issues
__ Employee Availability
__ Safety
__ Total System Shutdown Necessary
__ Traffic Control Issues
__ Material Delivery
__ Improved Lighting Technology
__ Higher Efficiency
__ Longer Work Periods
__ Other _____

Comments: _____

_____

_____

2. Which of the following problems have you encountered during night operations? (Check all that apply)

__ Quality
__ Safety
__ Productivity
__ Employee Morale
__ Lighting
__ Traffic Control
__ Employee Availability
__ Equipment Maintenance
__ Material Delivery
__ Public Irritation
__ Decision Making/Communication Issues
__ Traffic Interference
__ Other _____

Comments: _____

_____

_____

3. In the past 12 months how many projects involving nighttime construction work has your state conducted? _____

What is the approximate total dollar value of these projects? _____

What percentage of this work was performed in rural areas? _____%

What percentage of this work was performed in urban areas? _____%

4. On a 1-5 scale (1-very negative, 3-no effect, 5-very positive) how has night work affected:

Project Schedule:	1	2	3	4	5
Project Cost:	1	2	3	4	5
Project Safety:	1	2	3	4	5

5. Check any of the following activities with which you have had experience with working at night. If you have experience with an activity please rate on a 1-5 scale (1-very negative, 3-no effect, 5-very positive) how night operations affected quality and productivity.

__ Earthwork
Quality: 1 2 3 4 5
Productivity: 1 2 3 4 5

__ Bridge Deck Pour
Quality: 1 2 3 4 5
Productivity: 1 2 3 4 5

__ Bridge Deck Overlay
Quality: 1 2 3 4 5
Productivity: 1 2 3 4 5

__ Structural Bridge Work
Quality: 1 2 3 4 5
Productivity: 1 2 3 4 5

__ Concrete Pavement
Quality: 1 2 3 4 5
Productivity: 1 2 3 4 5

__ Asphalt Pavement
Quality: 1 2 3 4 5
Productivity: 1 2 3 4 5

__ Blasting
Quality: 1 2 3 4 5
Productivity: 1 2 3 4 5

__ Drainage/Utilities
Quality: 1 2 3 4 5
Productivity: 1 2 3 4 5

__ Rock Excavation
Quality: 1 2 3 4 5
Productivity: 1 2 3 4 5

__ Striping
Quality: 1 2 3 4 5
Productivity: 1 2 3 4 5

__ Sign Placement
Quality: 1 2 3 4 5
Productivity: 1 2 3 4 5

__ Traffic Control Systems
Quality: 1 2 3 4 5
Productivity: 1 2 3 4 5

6. What do you feel is the main advantage of performing work at night?

7. What do you feel is the main disadvantage of performing work at night?

8. Are there any additional comments that you would like to make?

9. Are you willing to discuss further issues related to Night-time Construction Operations with the researcher?

   __ Yes __ No

10. If YES, please specify the person(s) in your department to contact:

    Name: _____

    Position/Title: _____

    Address: _____

    _____

    _____

    City: _____ State: _____ Zip: _____

    Telephone: _____ Fax: _____

    E-mail Address: _____

Thank you for your cooperation. Please return this questionnaire by November 22, 1999 to

Dr. Donn E. Hancher
161 Raymond Building
University of Kentucky
Lexington, KY 40506-0281

TEL: (606) 257-4857
FAX: (606) 257-4404
email: hancher@engr.uky.edu

PLEASE FAX IF POSSIBLE

KYSPR-00-217

Night-time Construction Issues

CONTRACTOR QUESTIONNAIRE

PURPOSE OF THIS SURVEY

There is an increasing demand for performing many transportation construction and maintenance operations at night, especially in urban areas, to reduce the conflict with the traveling public. This approach can be beneficial for reducing traffic disruptions; however, there are several concerns to the Department of Highways and contractors which must be considered. There is a loss of productivity in doing work at night which may increase costs of the work and there is an increased risk for safety of the workers. There is also a major exposure for liability for the safety of the traveling public, and increased citizen complaints of noise near night-time project locations. Better guidelines are needed for utilizing night-time construction for KyTC construction projects.

Please complete the following request for information to aid in the processing of this survey:

Company: _____

Address: _____

_____

_____

City: _____ State: _____ Zip: _____

Questionnaire Completed By: _____

Position/Title: _____ Date: _____

Telephone: _____ Fax: _____

PLEASE RETURN QUESTIONNAIRE AND SUPPORTING INFORMATION BY: **11/22/99**

TO: Dr. Donn E. Hancher
161 Raymond Building
University of Kentucky
Lexington, KY 40506-0281

TEL: (606) 257-4857
FAX: (606) 257-4404
email: hancher@engr.uky.edu

THANK YOU FOR YOUR VALUABLE ASSISTANCE ON THIS PROJECT!!

PLEASE WRITE ON THE BACK OF ANY PAGES IF YOU NEED MORE SPACE FOR YOUR RESPONSES

KYSPR-00-217 Company: _____

1. Which of the following contribute to your decision to work at night? (Check all that apply)

__ High Daytime Traffic Levels
__ Schedule Issues
__ Road User Costs
__ Temperature Concerns
__ Noise Issues
__ Rental Equipment
__ Economic Issues
__ Quality Issues
__ Less Competition
__ Contract Incentives
__ Safety
__ Total System Shutdown Necessary
__ Traffic Control Issues
__ Material Delivery
__ Improved Lighting Technology
__ Higher Efficiency
__ Longer Work Periods
__ Other _____

Comments: _____

_____

_____

2. Which of the following problems have you encountered during night operations? (Check all that apply)

__ Quality
__ Safety
__ Productivity
__ Employee Morale
__ Lighting
__ Traffic Control
__ Equipment Maintenance
__ Material Delivery
__ Public Irritation
__ Decision Making/Communication Issues
__ Employee Availability
__ Other _____

Comments: _____

_____

_____

3. On a 1-5 scale (1-very negative, 3-no effect, 5-very positive) how has night work affected:

Project Schedule:	1	2	3	4	5
Project Cost:	1	2	3	4	5
Project Safety:	1	2	3	4	5

4. Approximately how many nighttime projects has your company been involved with?_____

5. What special work rules are you applying to your labor force at night?

_____

_____

_____

_____

_____

_____

Company: _____

6. Check any of the following activities with which you have had experience with working at night. If you have experience with an activity please rate on a 1-5 scale (1-very negative, 3-no effect, 5-very positive) how night operations have affected quality and productivity.

__ Earthwork					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Bridge Deck Pour					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Bridge Deck Overlay					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Structural Bridge Work					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Concrete Pavement					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Asphalt Pavement					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Blasting					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Drainage/Utilities					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Rock Excavation					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Striping					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Sign Placement					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Traffic Control Systems					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5

7. What do you feel is the main advantage of performing work at night?

8. What do you feel is the main disadvantage of performing work at night?

9. Are there any additional comments that you would like to make?

 Company: _____

10. Are you willing to discuss further issues related to Night-time Construction Operations with the researcher?

    __ Yes __ No

11. If YES, please specify the person(s) in your company to contact:

    Name: _____

    Position/Title: _____

    Address: _____

    _____

    _____

    City: _____ State: _____ Zip: _____

    Telephone: _____ Fax: _____

    E-mail Address: _____

Thank you for your cooperation. Please return this questionnaire by November 22, 1999 to

Dr. Donn E. Hancher
161 Raymond Building
University of Kentucky
Lexington, KY 40506-0281

TEL: (606) 257-4857
FAX: (606) 257-4404
email: hancher@engr.uky.edu

PLEASE FAX IF POSSIBLE

KYSPR-00-217

Night-time Construction Issues

KyTC RESIDENT ENGINEER QUESTIONNAIRE

PURPOSE OF THIS SURVEY

There is an increasing demand for performing many transportation construction and maintenance operations at night, especially in urban areas, to reduce the conflict with the traveling public. This approach can be beneficial for reducing traffic disruptions; however, there are several concerns to the Department of Highways and contractors which must be considered. There is a loss of productivity in doing work at night which may increase costs of the work and there is an increased risk for safety of the workers. There is also a major exposure for liability for the safety of the traveling public, and increased citizen complaints of noise near night-time project locations. Better guidelines are needed for utilizing night-time construction for KyTC construction projects.

Please complete the following request for information to aid in the processing of this survey:

District: _____

Address: _____

_____

_____

City: _____ State: _____ Zip: _____

Questionnaire Completed By: _____

Position/Title: _____ Date: _____

Telephone: _____ Fax: _____

PLEASE RETURN QUESTIONNAIRE AND SUPPORTING INFORMATION BY: **1/19/00**

TO: Dr. Donn E. Hancher
161 Raymond Building
University of Kentucky
Lexington, KY 40506-0281

TEL: (606) 257-4857
FAX: (606) 257-4404
email: hancher@engr.uky.edu

THANK YOU FOR YOUR VALUABLE ASSISTANCE ON THIS PROJECT!!

PLEASE WRITE ON THE BACK OF ANY PAGES IF YOU NEED MORE SPACE FOR YOUR RESPONSES

 District: _____

1. Which of the following heavily contribute to your decision to work at night? (Check all that apply)

__ High Daytime Traffic Levels
__ Schedule Issues
__ Road User Costs
__ Temperature Concerns
__ Noise Issues
__ Rental Equipment
__ Economic Issues
__ Quality Issues
__ Employee Availability
__ Safety
__ Total System Shutdown Necessary
__ Traffic Control Issues
__ Material Delivery
__ Improved Lighting Technology
__ Higher Efficiency
__ Longer Work Periods
__ Other _____

Comments: _____

_____

_____

2. Which of the following problems have you encountered during night operations? (Check all that apply)

__ Quality
__ Safety
__ Productivity
__ Employee Morale
__ Lighting
__ Traffic Control
__ Employee Availability
__ Equipment Maintenance
__ Material Delivery
__ Public Irritation
__ Decision Making/Communication Issues
__ Traffic Interference
__ Other _____

Comments: _____

_____

_____

3. In the past 12 months how many projects involving nighttime construction work have you personally been involved with? _____

What is the approximate total dollar value of these projects? _____

What percentage of this work was performed in rural areas? _____%

What percentage of this work was performed in urban areas? _____%

4. On a 1-5 scale (1-very negative, 3-no effect, 5-very positive) how has night work affected:

Project Schedule:	1	2	3	4	5
Project Cost:	1	2	3	4	5
Project Safety:	1	2	3	4	5

5. Check any of the following activities with which you have had experience with working at night. If you have experience with an activity please rate on a 1-5 scale (1-very negative, 3-no effect, 5-very positive) how night operations affected quality and productivity.

__ Earthwork					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Bridge Deck Pour					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Bridge Deck Overlay					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Structural Bridge Work					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Concrete Pavement					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Asphalt Pavement					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Blasting					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Drainage/Utilities					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Rock Excavation					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Striping					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Sign Placement					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5
__ Traffic Control Systems					
Quality:	1	2	3	4	5
Productivity:	1	2	3	4	5

6. What do you feel is the main advantage of performing work at night?

7. What do you feel is the main disadvantage of performing work at night?

8. Are there any additional comments that you would like to make?

9. Are you willing to discuss further issues related to Night-time Construction Operations with the researcher?

   __ Yes __ No

10. If YES, please specify the person(s) in your department to contact:

    Name: _____

    Position/Title: _____

    Address: _____

    _____

    _____

    City: _____ State: _____ Zip: _____

    Telephone: _____ Fax: _____

    E-mail Address: _____

Thank you for your cooperation. Please return this questionnaire by January 19, 2000 to

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PLEASE FAX IF POSSIBLE

State	High Daytime Traffic Levels	Schedule Issues	Road User Cost	Temp. Concerns	Noise Issues	Rental Equip.	Economic Issues	Quality Issues	Employee Avail.	Safety	System Shutdown	Traffic Control	Material Delivery	Improved Lighting	Higher Efficiency	Longer Work Periods	Other
Arizona	x			x						x		x					
Arkansas	x	x	x							x	x	x				x	x
California	x	x	x							x							
Connecticut	x						x					x					
Delaware	x									x		x					
Georgia	x											x				x	
Hawaii	x		x									x				x	x
Idaho	x		x								x	x					
Illinois	x		x									x	x				
Indiana	x		x							x			x			x	
Iowa	x									x							
Kansas	x			x								x					
Louisiana	x	x	x	x							x	x					
Maine	x											x					
Maryland	x	x		x													
Michigan	x	x	x	x				x			x	x	x			x	x
Minnesota	x												x			x	
Mississippi	x		x									x					
Montana																	x
Nebraska																	
Nevada	x			x	x			x				x					x
New Hampshire																	
New Jersey	x	x	x								x	x				x	x
North Dakota		x		x												x	x
Pennsylvania	x											x					
Rhode Island	x	x			x					x		x	x		x		
South Carolina	x									x							x
Texas	x																
Utah	x	x	x	x						x		x				x	
Washington	x	x	x	x								x	x			x	
Wisconsin	x	x					x					x			x	x	x
Wyoming	x		x									x				x	
Totals:	**28**	**11**	**13**	**9**	**2**	**0**	**2**	**2**	**0**	**9**	**5**	**21**	**6**	**0**	**2**	**12**	**9**

State	Quality	Safety	Productivity	Employee Morale	Lighting	Traffic Control	Employee Avail.	Equip. Main.	Material Delivery	Public Irritation	Comm. Issues	Traffic Interference	Other
Arizona	x		x		x								
Arkansas	x	x		x	x	x	x			x	x		
California		x	x		x					x			
Connecticut	x	x	x		x	x				x	x		
Delaware			x	x				x					
Georgia	x												
Hawaii	x	x		x			x		x	x			
Idaho	x	x	x		x	x	x				x		
Illinois	x	x								x	x		
Indiana	x	x	x				x	x					
Iowa			x		x				x	x			
Kansas	x	x			x								
Louisiana			x	x		x	x		x				
Maine		x		x	x					x	x	x	
Maryland							x			x			
Michigan	x	x	x		x	x							
Minnesota	x	x	x		x				x				
Mississippi							x		x				
Montana	x	x	x	x			x			x			
Nevada	x	x	x	x	x	x					x		
New Jersey	x			x	x		x			x			x
North Dakota	x			x									
Pennsylvania	x	x			x	x	x						
Rhode Island		x		x	x		x		x	x			
South Carolina	x		x						x				
Texas			x		x					x	x		
Utah	x	x	x	x	x	x	x	x	x	x	x		
Virginia													
Washington	x	x	x	x	x					x	x	x	
Wisconsin	x	x		x	x	x	x		x	x	x		
Wyoming			x		x								
Totals:	**20**	**18**	**17**	**13**	**19**	**9**	**13**	**3**	**9**	**15**	**10**	**2**	**1**

State	Number of Projects	Dollar Value	% Rural	% Urban	Project Schedule	Project Cost	Project Safety
Arizona	5	$276,000,000	0%	100%	4	2	3
Arkansas	7	$44,500,000	25%	75%	4	3	3
California	N/A	N/A	10%	90%	2	2	3
Connecticut	50	$200,000,000	10%	90%	3	3	2
Delaware	10	$20,000,000	0%	100%	4	2	4
Georgia	30	$100,000,000	20%	80%	4	2	3
Hawaii	11	$34,000,000	15%	85%	4	2	2
Idaho	6	$58,000,000	5%	90%	4	3	2
Illinois	6	$30,000,000	10%	90%	4	2	2
Indiana	25	$200,000,000	10%	90%	5	2	3
Iowa	6	$2,000,000	10%	90%	5	2	4
Kansas	2	$3,500,000	0%	100%	4	2	2
Louisiana	6	$150,000,000	0%	100%	4	2	3
Maine	1	$4,800,000	?	?	4	4	2
Maryland	20	N/A	10%	90%			

DOT Survey Results
Questions 3 and 4

Appendix B-1

State	Number of Projects	Dollar Value	% Rural	% Urban	Project Schedule	Project Cost	Project Safety
Michigan	111	$270,000,000	35%	65%	5	2	2
Minnesota	15	N/A	2%	98%	4	4	3
Mississippi	2	$28,000,000	0%	100%	4	3	4
Nevada	50	$200,000,000	25%	75%			
New Jersey	20	$100,000,000	10%	90%	4	2	3
North Dakota	2	$4,000,000	100%	0%	5	1	
Pennsylvania	150	$400,000,000	10%	90%	3	3	2
Rhode Island	10	$15,000,000	25%	50%	4	4	3
South Carolina	8	$75,000,000	10%	90%	2	2	4
Utah	3	$34,430,119	0%	100%	3	3	3
Washington	47	$216,000,000	5%	95%	3	3	3
Wisconsin	3	$29,100,000	20%	80%	4	1	2
Wyoming	15	$30,000,000	90%	10%	3	3	3
Minimum	1	$2,000,000	0	0	2	1	2
Maximum	150	$400,000,000	1	1	5	4	4
Average	23.0	$100,973,205	0.2	0.8	3.8	2.5	2.8

State	Earthwork		Bridge Deck Pour		Bridge Deck Overlay		Struc. Bridge Work		Concrete Pavement		Asphalt Pavement		Blasting		Drainage/Utilities		Rock Excavation		Striping		Sign Placement		Traffic Control Systems	
	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.
Arizona	3	5	2	3			3	4	2	3	2	4			3	3			3	5	3	3	3	3
Arkansas			3	4			3	3	3	3	3	3			3	5			3	3	3	3	3	3
California	3	2	3	3	3	2	3	2	2	2	2	2			3	3			2	2			2	2
Connecticut	2	2	2	2	3	2	3	2			3	3			3	3	3	3	3	3	3	3	3	3
Delaware			4	3	3	3	3	3			3	3												
Georgia	3	2	3	3	3	3	3	3	3	3	2	3			3	3			3	3	3	3		
Hawaii	4	4							4	4	3	4			3	3			3	3	4	4	3	3
Illinois											2	4							3	3	3	3	3	3
Indiana	3	3	2	3	2	3	3	3	2	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3
Iowa	3	3	3	3	3	3	3	3	3	3	2	3							3	3				
Kansas	3	3	3	2	3	2					2	2												
Louisiana			2	3					3	5	2	4							2	4	3	5	3	4
Maine			5	3	3	3	2	2			3	4			3	3	3	3	2	2			4	4
Maryland	3	3	4	3		3	3	3	2	3	3	4			3	4	3	3			2	2	3	3
Michigan			5	3	5	3	3	2	2	3	2	3											1	1
Minnesota	3	3	2	2	2	2			2	2	2	3							3	3	3	3	3	4
Mississippi			4	4							4	4							4	4				
Montana	3	2	3	2							3	2												
Nevada			2	3	2	3			2	3	1	2							1	2			2	2
New Jersey					3	4	3	3			2	4			3	3			4	5				
North Dakota							4	4			3	3												
Pennsylvania	2	2	4	3	4	3					2	3												
Rhode Island	3	4			3		2	3			1	5	3	3	2	3	3	3	4	5			3	4
South Carolina	3	2	2	3	2	3					2	3			3	3			3	4	3	3	3	3
Texas	2	2	3	4	3	4	4	4	3	2	3	2	3	4	3	2			4	3				
Utah	3	3	3	4	2	5			3	4	2	3	4	4					4	4			4	4
Washington	3	3	2	3	3	3	3	2	2	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3
Wisconsin	3	3	2	4	2	3	3	4			3	4							2	3	3	4	3	3
Wyoming	3	2	3	2	3	2			3	2														
Minimum	2	2	2	2	2	2	2	2	2	2	1	2	3	3	2	2	3	3	1	2	2	2	1	1
Maximum	4	5	5	4	5	5	4	4	4	5	4	5	4	4	3	5	3	3	4	5	4	5	4	4
Average	2.9	2.8	3.0	3.0	2.9	3.0	3.0	2.9	2.6	3.1	2.4	3.3	3.2	3.4	2.9	3.1	3.0	3.0	3.0	3.3	3.0	3.2	2.9	3.1

Additional comments from Question 1.

Specifications require night work for PCCP when temperature is over 100°F. No lane restrictions allowed on urban freeways during daylight hours (weekdays). **AZ**

Typically night work is beneficial on high volume roadways by minimizing inconvenience & disruption. **AR**

Primary concern is that closing lanes in daytime could cause traffic delays. **CA**

Night work will be required in areas of high traffic volumes where the traffic impacts of construction will results in extensive delays and resulting economic impact. **CT**

Traffic volumes are the single factor for specifying lane closures at night. **GA**

Disasters have necessitated night work, this is not counted in the survey. **ID**

Safety can actually be better at night in some cases due to less congestion: this can effect material delivery. **IN**

Night time construction decisions are based on highway capacity (or lack thereof) and potential decreases in safety with daytime work activities due to less lane availability. **IA**

Contractor elected to work at night to increase productivity. **ME**

MDT does not specify nighttime work. Contractors may elect to work at night provided they meet the department requirements for night work. See 95 editions of Standard Specifications. **MT**

Lots of politics involved. **NV**

In the interest of the public to provide them with the roadway during their peak demand periods. **NJ**

Our specifications do not address nighttime work, in this case the contractor initiated nighttime work to either complete ahead of schedule or to reduce liquidated damages. **ND**

Generally quality of construction suffers with night-time construction. It's more difficult to inspect. **UT**

Some [districts] had temperature concerns for paving while another expressed it for durable pavement markings. High daytime traffic levels and material delivery were the most common responses from WSDOT Regions. **WA**

Additional comments from Question 2.

Quality can be jeopardized due to lighting problems/shadows affecting finish/surface texture/profile.
Safety: motorist alertness/worker safety
Lighting: Glare/Blinding of Motorist.
Traffic Control: Must monitor devices continuously to ensure proper operation, especially message panels. **AR**

Night work has numerous inherent problems associated with it. **CT**

Some minor asphalt issues that would have been identified earlier in daytime. **GA**

Restrictions by local ordinances with respect to noise, light, or traffic. **ID**

Night limits visibility, even with lights, which can make it more unsafe. **IN**

Lighting uniformity without glare has been an issue. Glare causes motorists problems. Some materials are more expensive for night work. Productivity is also lower. We have not seen problems related to safety. **IA**

Striping, night paving was impeded by traffic in morning hours. Lighting could be improved.
Safety: Speeding traffic-overloaded trucks. **ME**

During recent years, down sizing has made it more difficult to staff projects working double shifts. **MD**

Public Irritation includes noise, lighting glare, and trucking routes for material delivery. **NJ**

Although safety is a concern, we have not experienced injuries or death attributed to night work. **ND**

Harder to achieve quality product at night due to darkness factor. Scheduling personnel difficult. **UT**

One Region does not place the top lift of asphalt concrete pavement at night due to concerns with quality. Quality, safety, employee morale, and lighting are the most common responses. **WA**

What do you feel is the main advantage of performing work at night?

Able to handle traffic volumes. **AZ**

Lower traffic volumes: Less disruption to motorist or inconvenience. **AR**

It avoids delays to the public during high commute/travel times. **CA**

Night work allows lane closures to occur during periods of reduced traffic volumes. Delays and congestion are reduced. It also allows for a full work shift rather than a 5-6 hour shift between rush hour periods. **CT**

Reduces the impact to the traveling public. **DE**

Avoiding peak traffic volumes. Are able to close more lanes for longer periods. **GA**

Less inconvenience to the public. Faster completion time. **HI**

Less inconvenience to the traveling public. **ID**

Reduces delays to motorist. **IL**

Most of the work done at night in Indiana is done because the contractor is working 2 shifts due to tight schedules. Therefore night work gets contractors' completion accelerated. Also traffic may be lighter at night in some areas. **IN**

Highway capacity availability (i.e.) lower traffic volumes allow for lane closures without increasing congestion and delays. **IA**

When scheduled at night repairs to heavily traveled roadways causes less traffic congestion. **KS**

Less interference with public. **LA**

Reduced negative impact on the traveling public and businesses in the immediate area of the project. **ME**

Traffic volumes on our metropolitan interstate highways are so high that any construction or maintenance activities on these roadways during the daytime would result in serious congestion problems. **MD**

To expedite the completion of projects; in turn shorter the time on the roadways inconveniencing the motoring public. On bridge deck and overlay work, night work is required to prevent microcracking due to temperature change. **MI**

Less traffic. Better public perception. Safety. **MS**

Shortened project duration, lower ADTs. **MT**

Lower traffic volumes. Lower temperatures in southern Nevada during summer. More freedom/flexibility in contractor's operations. **NV**

Reduced impact on traffic. Greater productivity on material delivery sensitive work. Longer productive work shifts (at least 8 hours long). **NJ**

Scheduling is the main advantage. On one structure project built in 1988 the contractor scheduled two shifts to complete a 2 year project in one year with a substantial bonus. In 1998 and 1999 one asphalt paving contractor installed lights on the paving equipment and at the plant and extended the day, limited by temperature, to complete several projects. **ND**

Minimize congestion for commuters (major traffic flow) during rush hour. **PA**

The biggest advantage of nighttime operations is the reduced impact to the motoring public. By working off peak hours delays and disruption to travelers are greatly diminished. With this reduction productivity has generally increased. Where once man power and equipment were confined by the onslaught of daily traffic crews are now able to work unhindered in their performance of the required task. **RH**

Less inconvenience to the traveling public. Work is performed when traffic volumes do not produce a significant backup when lane closures are required. **SC**

Lower traffic volumes. We can more easily detour traffic and close freeways if necessary. **TX**

Less traffic congestion, less impact on traveling public. Increased productivity (double shifts). Best or only time some activities can be worked on. **UT**

Less interference with public traffic during peak hours. Comment made on the benefit of using variable message signs to help address safety concerns. Other comments on the benefit of increased work hours on the roadway and more timely project completion. **WA**

Longer Work Periods. Ability to close 2nd lane on 3 lane Freeway which would be impossible for daytime work due to high traffic volumes. No delay on delivery of material. Keeps the economy of the area moving because deliveries don't get delayed by traffic jams. Less impact to traveling public. **WI**

Allows utilization of more hours in a short construction season and reduces the impact to daytime travelling public. **WY**

What do you feel is the main disadvantage of performing work at night?

Quality is not as good as daytime. No matter how you light the area you cannot see as well. **AZ**

Reduced visibility and capacity for quality control/inspection for work requiring visual inspection. Lose ability to see the work due to shadows and contrast, quality can suffer as a result. Worker safety: decrease in safety due to decreased motorist alertness. **AR**

Limited hours. In our urban areas even night work has limited work windows of down to 6 hours from 10PM to 4AM. The noise factor for neighbors can restrict the type of work done. **CA**

Quality and safety are reduced at night due to visibility issues. In addition, in residential areas night work has an impact on adjacent properties due to inherent noise of construction operations. Agencies must be prepared to address these issues through proper advanced planning, specification modifications and communications. **CT**

Employee "Burn-out." Reduced time for equipment maintenance. **DE**

Our biggest problem, and it has not been a major one, is that some problems with asphalt paving aren't as evident in the lower visibility. **GA**

Increased safety concerns (reduced visibility, fatigue, drunk drivers, etc.). **HI**

Safety is a big concern. Quality of lighting is poor. **ID**

Safety/Quality of work. **IL**

Visibility can effect quality and maybe safety but not always. Noise in urban areas at night can be a problem as can lights in residential areas. **IN**

Potential for poorer quality and harder material deliveries. **IA**

Decreased worker safety. **KS**

Manpower needs. **LA**

In places where the construction is taking place in close proximity to a residential area we are concerned about potential disruption to the adjacent community. **MD**

Safety to the workers and glare of the lights. We had two contractor employees hit by vehicles this year during night work. Both were moving plastic drums at the time. Also the intense glare at times literally blinds the motorist if the lights are not aimed correctly. **MI**

Scheduling Employees/Equipment. **MS**

Increased opportunity for construction and traffic related accidents. **MT**

Quality, safety, stress on contractor and state staff. Contractors tend to overextend their people more. **NV**

Quality of workmanship. Human factors: workers dealing with non-standard work hours, including fatigue. Perception of a higher safety risk of working at night and in dark areas. **NJ**

Although no one was hurt because of night work, safety is a big concern. Second seems to be quality of the asphalt pavement surface. Roller marks could be seen the next day. Changes in construction procedures will increase the quality. On both asphalt paving projects, nightly safety meetings were held and additional manpower was used to insure safety. **ND**

Work force stability. Large turnover on night work. The new people do not have the safety experience. **PA**

The downside of night time work is the overall quality of the final product. Many operations are dependent upon the ability to detect subtle irregularities in the ongoing operation. With out the advantage of sunlight, the presence of a dark area and shadows, these anomalies are more pronounce. This decrease in visibility also can increase the risk of safety of workers. Finally, night time operations also tend to disrupt the quietness of households that are within the source of sound of a particular operation. **RI**

Productivity is less because of the restricted number of hours the contractor is able to work. **SC**

There is less productivity at night. Most truck drivers delivering asphalt have already worked the day shift. Lights cause shadows and reflections which make visual inspection difficult. There appear to be dips in the asphalt which turn out to be only reflections. **TX**

Quality of product lessened due to darkness. Temperature becomes more critical. Material supply issues (sometimes not available). Safety of workers and difficult for employees to schedule night-shifts with normal off work activities. **UT**

Quality, with particular comments on asphalt paving. Safety concerns were next. One comment expressed concern about not being able to contract third parties, such as utilities, to address unanticipated events. **WA**

Poor lighting which leads to less quality. Employees are not as alert which could be dangerous. Workmanship is not as good because employees are tired. Employee attitudes are not as positive because night work is disruptive to their schedules.

Contractors' employees have negative attitudes because they loose overtime hours due to restricted Friday and Saturday night work. **WI**

The productivity of the contractor and state DOT is reduced. **WY**

Are there any additional comments that you would like to make?

Temperature limitations for product applications is sometimes restrictive at night. Illumination of work zone often blinds oncoming traffic. Alcohol impaired drivers are more numerous at night. Overall, off-peak (P.M.) work schedules work well during summer construction season with longer daylight and more comfortable temperatures. **AR**

Georgia has been allowing/specifying nightime work in urban areas for several years. We do not change any of out specifications nor do we add any special requirements for nightime work. **GA**

Trend is to do more night time work in urban areas. **ID**

Please refer to NCHRP 17-17 research and NCHRP 5-13(1) and S-13(2) for additional information regarding night time construction. Also NCHRP sythesis 218 may provide further information. **IA**

This is going to get more and more important due to ever increasing traffic—technology improvements will allow it to get easier but it will probably always cost more. **ME**

We also use night lighting for bridge paint removal (blasting) and painting in urban areas. MDOT intends to increase our use of night work. The increased use will mainly be due to expediting projects. We are actively looking at ways to adequately illuminate the work but at the same time to lesson the impact of the glare on the motoring public. **MI**

Most night work is determined by the traffic count. See attached schedule for allowable lane closer. We also have one complete section in our special provision that refer to night construction (see attached). When we first started night work approximately eight years ago we had trouble with materials suppliers. Ready mix plant had extra charges for night work. They still do buy there are more plants willing to stay open. B. P. Plant had trouble with noise to surrounding areas. Truck hauling on local streets. **MN**

Success is contractor/project specific. It works better with different companies than others. Scope of work is an area of concern also. Volumes are a greater concern than quality for some contractors. **NV**

It is very difficult to see aspects of asphalt work at night. Recommend evaluating off peak hours in lieu of night work. **PA**

Use night work only when day work is not feasible. **TX**

Night work is necessary in some circumstances, maybe even preferred, but generally daytime is better. Strain on crews, especially if they are understaffed. **UT**

Contractors don't have an adequate work force to work day and night time hours. Employees have difficult time going between projects if some are day and some are night. There is a lost day of work every time you switch between the two. People drive faster due to less volume at night. **WI**

Contractor	High Daytime Traffic Levels	Schedule Issues	Road User Cost	Temp. Concerns	Noise Issues	Rental Equip.	Economic Issues	Quality Issues	Less Competitio	Contract Incentives	Safety	System Shutdown	Traffic Control	Material Delivery	Improve Lighting	Higher Efficienc	Longer Work Periods	Other
Allen Company	x	x								x	x	x	x	x	x	x		
Ballenger Paving	x	x		x						x	x		x					
A.S.L. Excavating	x	x				x				x	x							
Central Rock Company	x	x		x			x			x	x		x			x	x	
Central Seal Company	x																	
Charbon Bridge Co.																		
Dillion Construction	x	x		x						x	x		x			x		
Eaton Asphalt Paving	x												x				x	
Elmo Greer & Sons	x	x		x						x	x		x	x		x		
Harper Company		x	x							x	x		x				x	
H.G. Mays Corp.	x									x								
Hinkle Contracting	x	x																
Intech Contracting, Inc.				x						x		x	x					
Judy Construction	x	x		x						x		x	x					
Loiusville Paving Co.	x												x	x			x	
Mick-Murf Construction	x	x		x														
Milestone Contractors	x	x	x							x				x		x	x	
Rogers Group, Inc.	x									x	x		x				x	
Scotty's Contracting	x	x		x			x			x	x		x		x	x		
Walker Company, Inc.	x	x		x	x			x		x	x	x	x	x	x		x	
Totals:	**17**	**13**	**2**	**9**	**1**	**1**	**2**	**1**	**0**	**14**	**10**	**4**	**13**	**5**	**3**	**6**	**7**	**0**

Contractor	Quality	Safety	Productivity	Employee Morale	Lighting	Traffic Control	Equip. Main.	Material Delivery	Public Irritation	Comm. Issues	Employee Avail.	Other
Allen Company	x				x		x	x	x			
Ballenger Paving	x	x	x	x	x	x	x	x	x	x	x	
A.S.L. Excavating	x	x			x	x		x				
Central Rock Company	x		x		x	x	x	x			x	
Central Seal Company	x	x	x	x								
Charbon Bridge Co.	x	x	x	x	x	x	x			x	x	
Dillon Construction							x	x				
Eaton Asphalt Paving		x	x	x	x	x	x				x	
Elmo Greer & Sons	x	x	x	x	x	x	x	x	x	x	x	
Harper Company	x		x									
H.G. Mays Corp.	x	x			x		x				x	
Hinkle Contracting	x	x			x		x					
Intech Contracting, Inc					x		x	x		x		
Judy Construction	x	x	x		x		x					
Loiusville Paving Co.	x	x	x		x							
Mick-Murf Construction								x				
Milestone Contractors	x	x		x	x	x					x	
Rogers Group, Inc.	x			x	x							
Scotty's Contracting												
Walker Company, Inc.	x	x	x	x	x	x	x	x	x	x	x	
Totals:	**15**	**12**	**10**	**8**	**15**	**8**	**12**	**9**	**4**	**5**	**8**	**0**

Contractor Survey Results
Questions 3 and 4

Contractor	Number of Projects	Project Schedule	Project Cost	Project Safety
Allen Company	20	4	4	3
Ballenger Paving		2	1	2
A.S.L. Excavating	5	5	3	4
Central Rock Company		3	3	3
Central Seal Company	2	1	1	3
Charbon Bridge Co.	100	3	2	3
Dillion Construction	4	5	3	4
Eaton Asphalt Paving		4	4	2
Elmo Greer & Sons		4	4	2
Harper Company	10	5	3	4
H.G. Mays Corp.	4	4	2	2
Hinkle Contracting	10	3	3	2
Intech Contracting, Inc.	5	4	2	4
Judy Construction	10	3	2	2
Loiusville Paving Co.	15	4	3	2
Mick-Murf Construction	1	3	2	4
Milestone Contractors	20	4	3	2
Rogers Group, Inc.	2	4	4	2
Scotty's Contracting	10	5	4	4
Walker Company, Inc.	7	3	3	3
Minimum	**1**	**1**	**1**	**2**
Maximum	**100**	**5**	**4**	**4**
Average	**14.1**	**3.7**	**2.8**	**2.9**

Contractor	Earthwork		Bridge Deck Pour		Bridge Deck Overley		Struc. Bridge Work		Concrete Pavement		Asphalt Pavement		Blasting		Drainage/Utilities		Rock Excavation		Striping		Sign Placement		Traffic Control Systems	
	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.	Quality	Prod.
Allen Company	3	4							2	3	3	3			3	2	3	4						
Ballenger Paving	2	2							3	2	3	2												
A.S.L. Excavating																								
Central Rock Company	3	3	3	3					3	3	2	3			3	2	3	3					3	3
Central Seal Company																			3	2				
Charbon Bridge Co.			5	4	4	4					3	2												
Dalton Construction	2	2	5	5			5	5	4	4			1	1	3	3	4	4			1	1	4	4
Eaton Asphalt Paving											4	4											2	2
Elmo Greer & Sons	3	4	4	4	4	4	3	3	3	3	3	4					4	4	3	3	3	3	3	4
Harper Company	2	2							2	2													3	5
H.G. Mays Corp.											2	3												
Hinkle Contracting	3	3									2	3												
Intech Contracting, Inc.			4	4	4	4	3	2																
Judy Construction			3	3			3	3															3	3
Loiusville Paving Co.											2	4											3	3
Mick-Murf Construction			3	4																				
Milestone Contractors	3	3					2	1			2	4			3	2			2	3				
Rogers Group, Inc.	3	3									2	3												
Scotty's Contracting											5	5											5	5
Walker Company, Inc.	3	4	4	4			3	3	2	3	2	3	3	3			3	4	3	4	3	3	3	3
Minimum	2	2	3	3	4	4	2	1	2	2	2	2	1	1	3	2	3	3	2	2	1	1	2	2
Maximum	3	4	5	5	4	4	5	5	4	4	5	5	3	3	3	3	4	4	3	4	3	3	5	5
Average	2.7	3.0	3.9	3.9	4.0	4.0	3.2	2.8	2.7	2.9	2.7	3.3	2.0	2.0	3.0	2.3	3.4	3.8	2.8	3.0	2.3	2.3	3.2	3.6

B-2-4

Additional Comments from Question 1

Production of night shift increases (reasons unknown). **A.S.L. Excavating**

Due to the nature of our business as a subcontractor work schedule is determined by the prime. **Charbon Bridge Co.**

With roadway traffic it seems in the business districts work seems to be safer, more productive, and better working relations with property owners affected by construction. **Dillon Construction Company**

Example: Concrete barrier walls could only be done at night due to the high summer time temperatures. **Elmo Greer & Sons, Inc.**

Contract completion incentives/penalties are the primary considerations. **The Harper Company**

On KYDOT work the hours on high traffic roadways are severely curtailed. To get anything done, the work is best done at night. **Louisville Paving Co., Inc.**

Night work provides the opportunity to achieve maximum utilization of resources. **Milestone Contractors, L. P.**

Total system shutdown necessary if temperature is cold enough to cause problems with equipment. Longer work periods are most of the time the main reason for night work. **Walker Company, Inc.**

On concrete projects the winter season with lower temperatures require longer set time, sometimes all night. **Walker Company, Inc.**

Additional Comments from Question 2

Checking grade seems to be our major problem. **A.S.L. Excavating**

None of our crews look forward to night shifts. Mechanical problems usually must be fixed during daylight hours when garages are open. **Central Seal Company**

In most cases where it is a decision to work at night, we have been very successful in all areas above with proper scheduling ahead except for unforeseen equipment failure and emergency delivered materials. **Dillon Construction Company**

Properly planned for, no differences in working night vs. day. However, placing PCC pavement at night will require some change to operations & specifications. **The Harper Company**

Traffic control is typically easier. Personnel hasn't been a problem (Jobs are usually high scale). **Intech Contracting, Inc.**

Quality if more related to cosmetics during night operations. Poor lighting is a serious safety concern. **Milestone Contractors, L. P.**

No problems encountered during night operations. **Scotty's Contracting and Stone Company**
Safety and lighting are always my problem but employee morale is always everyone's problem. **Walker Company, Inc.**

I don't like night work. **Walker Company, Inc.**

What special work rules do you apply to your labor force at night?

Wear light colored clothing—reflective vests in traffic. **The Allen Company, Inc.**

Every employee wears hard hats and reflective vests. Extra communication, lighting is being done to protect us and the traveling public. **Ballenger Paving**

No different than daytime rules. **A. S. L. Excavating, Inc.**

Nothing different than is asked of the labor force during the day—work safe, hard and efficient. **Central Rock Mineral Company**

Safety is stressed. **Charbon Bridge Co.**

Safety issues—based on road traffic conditions are explained and followed mandatory. Lighting is placed to assure positive daylight with regards to homeowners' request. Traffic devices are double placed and noise is kept to a minimum tolerance. **Dillon Construction Co.**

On I-75—wear safety vests, keep a vehicle between employee and traffic, provide extra lighting. **Elmo Greer & Sons, Inc.**

Additional emphasis on safety & safety devices. Assuring workers are alert—monitor working hours. **The Harper Co.**

Special emphasis on safety. **H. G. Mays Corporation**

Primarily to be more alert to traffic and other safety—related conditions. **Hinkle Contracting Corp.**

Higher visibility reflective tape, vests, etc. More flashing yellow lights. **Intech Contracting, Inc.**

Wear reflective clothing. **Judy Construction Company**

Reflective clothing, vests, etc. **Louisville Paving Company**

Coordinate with prime/material suppliers & inspectors. **Mick-Murf Construction, Inc.**

Illumination. Lighted safety vests. Reflective tape on hard hats. Advanced training to heighten safety awareness. Job specific night safety plan. **Milestone Contractors, L. P.**

Reflective vests and hard hats. **Rogers Group**

Same direction as day forces. **Scotty's Contracting and Stone Company**

No finish work. Example: Asphalt surface, Cutting sub-grade, etc.
No detailed work. Example: Installing storm drainage, Site utilities, etc. **Walker Company, Inc.**

Special safety precautions. **Walker Company, Inc.**

Safety 1st, then try for quality. Leave the more finer details for day shift. **Walker Company, Inc.**

Reflective clothing. **Walker Company, Inc.**

Safety precautions as the glare from equipment headlights and the light plants lower visibility. **Walker Company, Inc.**

Safety. **Walker Company, Inc.**

Wear Reflective Clothing. **Walker Company, Inc.**

What do you feel is the main advantage of performing work at night?

Paving—Less Traffic. Utility Tieing—Less Use. Earthmoving—Productivity. **The Allen Company**

Less traveling public to deal with. **Ballenger Paving Division.**

Less Traffic, more production. **A. S. L. Excavating, Inc.**

Only advantage would be if the job is highly impacted by the volume of vehicular traffic. If the job is impacted by high volumes of vehicular traffic and there is a significantly less volume at night, and the type of work to be performed can be done at night, then it is an advantage to work at night. **Central Rock Mineral Company**

Working at night allows a striping crew access to normally high traffic areas, I. E. I-264, the Walterson expressway in Louisville can only be successfully striped at night. **Central Seal Company**

Less Traffic. **Charbon Bridge Co.**

Summer Hours: Temperatures are lower, men's moral is focused. Traffic is slower and less dangerous. With proper scheduling production is greater with cost lower from labor -v- production. **Dillon Construction Company**

Less traffic to control. Better production because of less traffic. Workers are more comfortable (cooler). **Eaton Asphalt Paving Co., Inc.**

Lower temperature during summer. Lower traffic volumes. Lower equipment cost. **Elmo Greer & Sons, Inc.**

Contract incentives for early completion. Higher production for operations affect by traffic volumes. **The Harper Company**

In my opinion with our limited night time experience, the only advantage is to work during reduced traffic congestion. I will avoid night work unless forced to by incentive scheduling or contract requirements. **H. G. Mays Corporation**

Usually less traffic. In mid-summer, more comfortable working conditions. **Hinkle Contracting Corp.**

Less inconvenience to traffic. **Judy Construction Company**

Getting material (in our case asphalt mix) to the project in busy daylight hours our trucks get tied-up in our own created traffic jam. During extreme hot weather, the workers seem to like night work because of nominally cooler temperatures. **Louisville Paving Company, Inc.**

Allows for less traffic. Constant pour for supplier. **Mick—Murf Construction, Inc.**

Opportunity to achieve higher efficiency and productivity. Less inconvenience to traveling public. Less interruptions to construction operations. Helps stop bad media and negative publicity. Promotes positive attitudes from residents and the traveling public. **Milestone Contractors, L. P.**

Less traffic & getting project done on time by working day & night. **Rogers Group**

The ability to perform work with less traffic conditions. **Scotty's Contracting and Stone Company**

Greater productivity. Cooler temperature (in summer). Reduces equipment costs. Reduces overtime. If working in traffic—traffic delays would be less. **Walker Company, Inc.**

Less Traffic. Completing projects ahead of schedule. **Walker Company, Inc.**

The traffic is not as heavy on the road at night. **Walker Company, Inc.**

By working at night it gives the company a longer work period and also will keep the equipment warm in cold weather, making less maintenance problems. **Walker Company, Inc.**

Production on time delays. **Walker Company, Inc.**

There is not as much traffic in some areas. **Walker Company, Inc.**

Less traffic. **Walker Company, Inc.**

The temperature of the concrete in the mixers can be controlled at night, especially in hot, sunny weather. **Walker Company, Inc.**

None. **Walker Company, Inc.**

Less traffic. **Walker Company, Inc.**

What do you feel is the main disadvantage of performing work at night?

Paving—Quality of work—where there's hand work utility tie-ins—getting materials suppliers. Costs of light plants and having to keep extra help at night for maintenance. **The Allen Company**

Safety—we had 2 fatalities on projects. Both were hit by drunk drivers. That was 3 years ago. We also had a concrete saw blade salesman to visit our sawing and sealing subcontractor and he also was hit by a drunk driver. Caused life long disabilities. That was 2 years ago. **Ballenger Paving Division**

Hard to check grade, lighting at times is a minor problem. **A. S. L. Excavating, Inc.**

The majority of our work is in developed areas, so working at night is 1) against local laws or 2) very upsetting to people who are trying to sleep. When people are disturbed at night, they have a way about getting you stopped from working at night. Another major factor is getting materials delivered at night. Once again keep in mind that a lot of my work is in built up areas so there is not a lot of storage room for materials. A lot of the time we are working with the "just in time" scenario on having our materials delivered. **Central Rock Mineral Company**

Less quality. The lower night time drying time of traffic paints affects reflectivity. Less production. During the daylight hours we can stripe twice as many miles than as we can during night time hours. **Central Seal Company**

Break downs and morale. **Charbon Bridge Company**

Fast decision questions, equipment breakdowns, and unforeseen change in job plans. In some project locations and performance, noise to the public is unbearable and not tolerated very well. **Dillon Construction Company, Inc.**

Not all employees want to work at night. Equipment maintenance is always a problem at night. Both safety of employees and traffic safety is more of a problem at night. **Eaton Asphalt Paving Company**

Safety, maintenance, obtaining parts, materials delivery. **Elmo Greer& Sons, Inc.**

Scheduling workers for sporadic night time work. Safety in some situations. For PCC paving: material delivery, quality control, and current specifications. **The Harper Company**

Availability of experienced workforce to work at night while maintaining an experienced work force to work the normal day shift for non—DOT work. Life must go on even with these high priority night requirements. **H. G. Mays Corp.**

Being unable to secure equipment repair parts. **Hinkle Contracting Corp.**

Safety. **Judy Construction Company**

Quality. Difficult to see all small imperfections. Safety. We resurfaced the Walterson Expressway at night. Drunk drivers were numerous. A flagman was hit and barely survived. He never was able to work again. **Louisville Paving Company**

Very low morale among workers and agency personnel. Workers seem to become much more fatigued from midnight on. Less alertness among workers. Creates strong possibility of unsafe acts. Not enough lighting. Too much creates problems for job site deliveries, the traveling public and local residents. **Milestone Contractors, L. P.**

Getting people adjusted to the lighting and hazards of working nights. Getting employees the knowledge of temperature changes making density harder to achieve. **Rogers Group, Inc.**

No disadvantages. **Scotty's Contracting and Stone Company**

Shortage of manpower. Quality (for some items). Employees not wanting to work at night. **Walker Company, Inc.**

Safety. Quality of workmanship. **Walker Company, Inc.**

We can't see as well to know how we are doing. **Walker Company, Inc.**

Safety and employee morale are the two most recognized problems, but there are many more reasons that will contribute to problems working at night. **Walker Company, Inc.**

Visibility, personnel, and maintenance. **Walker Company, Inc.**

Quality and safety. **Walker Company, Inc.**

Poor visibility. Noise in residential areas. **Walker Company, Inc.**

Safety because of low visibility. Added cost of light plants and lighting equipment. **Walker Company, Inc.**

Safety. **Walker Company, Inc.**

Quality and productivity. **Walker Company, Inc.**

Are there any additional comments that you would like to make?

Earth and rock jobs double shifted have always improved productivity. Paving jobs done at night are productive during the mid summer months. In KY the temperature at night begins to effect work after September. Look for limitations on night paving on KyDOT projects for this reason. **The Allen Company**

Don't like it at all but what else can we do as an industry. **Ballenger Paving Company**

Have no problems with night work, like it just as well as daytime work. **A. S. L. Excavating**

Some types of work can be done at night very easily. Rough grading is easily done at night. Final grading and BWE topping are almost impossible at night. Lighting is a major factor. How large an area has to lit. How intense the lighting must be. Is the work going to be confined to one area or is it going to be moving constantly all night. If the work is moving constantly and at a fairly steady rate (fast) and a riding surface is being produced then it gets much more difficult to produce a quality product. **Central Rock Mineral Company.**

Eventually most striping will be done at night to avoid interrupting normal traffic. More work needs to be done finding better traffic paints for nighttime work. **Central Seal Company**

All projects are different. Location, traffic, and city vs. county projects all take considerations for the question of night work. Winter hours are very difficult to perform night work because of weather conditions and material delivery. **Dillon Construction Company, Inc.**

We have worked many projects at night. Highway, commercial, industrial, and FAA. All are different with different problems. **Eaton Asphalt Paving Company**

If the night work became consistent and uniform so that the night work force could be maintained throughout the construction season then this problem [worker availability] is reduced considerably. But construction projects are not consistent in any one area or scope of work. **H. G. Mays Corp.**

With improved lighting equipment, particularly on asphalt pavers, quality and safety concerns have become less of an issue. **Hinkle Contracting Corp.**

Generally I have many suggestions concerning road work (both day and night) performance under traffic. The first highway resurfacing project our company performed was in 1974. We have resurfaced and safely upgraded approximately 50 miles of interstate high ways in Kentucky ever since then. The problem is increasing year by year. Your study is certainly timely and important. I would like to see your report. Bill Dougherty. **Louisville Paving Company**

The results of a joint lighting study in the State of New York were released at the NAPA conference in October of this year. The presentation was interesting, but the most intriguing comment came at the close when the presenter stated that during this study, they actually noticed workers seemed to be more alert and much less fatigued. Milestone is very interested in the study. **Milestone Contractors, L. P.**

In addition to night time work we need to address the issue of "keeping traffic lanes closed until all safety features are installed." We (contractors) could open more lanes sooner if we were allowed to use temporary safety features (barrels, cones, etc.) before guardrail is installed. The traveling public gets upset when they see a lane closed for miles and no work taking place, especially if they're "creeping" along for miles. **Walker Company, Inc.**

I feel that with improved and increased lighting, quality of work and safety would improve. **Walker Company, Inc.**

Each job is different. What will work for one job might not work for the next. Each job needs to be considered and planned before starting a night shift to see if it will work for the benefit of everyone connected with it. **Walker Company, Inc.**

District	Engineer	High Daytime Traffic Levels	Schedul Issues	Road User Cost	Temp. oncern	Noise Issues	Rental Equip.	conomi Issues	Quality Issues	mployee Avail.	Safety	System hutdow	Traffic Control	Material Delivery	Improved Lighting	Higher fficienc	Longer ork Period	Other
2	Florence & Hutcheson	x	x		x								x					
2	Larry Gayner	x			x								x					
2	Jason Ward	x			x				x		x		x	x			x	
3	Otis Rigsby	x			x												x	
4	Josh Hornbeck	x			x									x				
5	Robert Harris	x			x							x	x	x			x	
5	Jamie King	x	x	x	x												x	
6	Terry King				x													
6	J. Peace	x		x									x					
6	Larry Stolz	x										x	x		x		x	
7	Charlotte Faeth	x			x			x			x		x					
7	Sarah McNiel	x			x							x	x					
7	Jake Stremmel	x			x				x		x	x	x					
8	Ronald Laugherty	x	x		x													x
9	Ed Broomell	x																
9	Paul Ford	x			x				x									
9	Larry Taylor																	x
10	Brian Billings	x	x	x		x			x		x		x		x			
10	Tony Bowling	x			x								x					
11	Phillip Howard	x	x	x	x				x	x	x	x	x					
11	Robert Moore	x	x	x									x				x	
12	George Collins	x			x								x					
12	Robin Justice	x	x		x													
	Totals:	**21**	**7**	**5**	**17**	**1**	**0**	**1**	**5**	**1**	**5**	**5**	**14**	**3**	**2**	**0**	**6**	**2**

District	Engineer	Quality	Safety	roductivit	Employee Morale	Lightin	Traffic Control	Employe Avail.	Equip. Main.	Material Delivery	Public Irritatio	Comm. Issues	Traffic nterferenc	Other
2	Florence & Hutcheson, Inc.				x	x					x	x		
2	Larry Gayner	x			x		x				x			
2	Jason Ward					x						x		
3	Otis Rigsby	x	x			x			x					
4	Josh Hornbeck	x	x									x		
5	Robert Harris	x	x		x	x	x	x			x	x		
5	Jamie King	x	x	x	x	x	x	x		x	x			
6	Terry King		x				x	x						
6	J. Peace	x	x	x	x	x	x		x	x	x			
6	Larry Stolz	x			x	x		x		x		x		
7	Charlotte Faeth		x				x						x	
7	Sarah McNiel	x	x		x			x		x		x		
7	Jake Stremmel	x	x	x		x	x							
8	Ronald Laugherty		x			x				x		x		
9	Ed Broomell													
9	Paul Ford					x	x							
9	Larry Taylor													
10	Brian Billings		x			x					x			
10	Tony Bowling	x				x								
11	Phillip Howard	x	x					x						
11	Robert Moore		x		x	x								
12	George Collins	x	x			x								
12	Robin Justice	x	x			x								
	Totals:	**13**	**15**	**3**	**8**	**15**	**8**	**6**	**2**	**5**	**6**	**7**	**1**	**0**

District	Engineer	Number of Projects	Dollar Value	% Rural	% Urban	Project Schedule	Project Cost	Project Safety
2	Florence & Hutcheson, I	0	0	N/A	N/A	4	3	3
2	Larry Gayner	5	$500,000	25%	75%	4	4	4
2	Jason Ward	3	$1,352,000	33%	67%	5	3	5
3	Otis Rigsby	1	$50,000	0%	100%	4	3	3
4	Josh Hornbeck	2	$12,000,000	90%	10%	3	3	2
5	Robert Harris	4	$23,110,000	25%	75%	4	2	3
5	Jamie King	4	$12,000,000	0%	100%	4	2	3
6	Terry King	1	N/A	100%	0%	3	3	3
6	J. Peace	2	$24,000,000	2%	98%	4	2	2
6	Larry Stolz	3	$6,000,000	0%	100%	5	4	4
7	Charlotte Faeth	0	$0	N/A	N/A	3	3	2
7	Sarah McNiel	5	$31,604,138	80%	20%	4	2	3

District	Engineer	Number of Projects	Dollar Value	% Rural	% Urban	Project Schedule	Project Cost	Project Safety
7	Jake Stremmel	4	$55,000,000	5%	95%	2	4	2
8	Ronald Laugherty	2	$35,000,000	70%	30%	3	3	2
9	Ed Broomell	1		100%	0%	5	4	3
9	Paul Ford	3	$300,000	35%	65%	3	3	4
9	Larry Taylor	1	$170,000	100%	0%	5	5	5
10	Brian Billings	1	$8,000,000	100%	0%	5	3	3
10	Tony Bowling	2	$451,000	20%	80%	3	3	4
11	Phillip Howard	2	$9,000,000	95%	5%	4	3	2
11	Robert Moore	2	$20,000,000	100%	0%	5	5	3
12	George Collins	2	$42,000,000	100%	0%	4	3	2
12	Robin Justice	1	N/A	N/A	N/A	3	3	2
	Minimum	0	$0	0%	0%	2	2	2
	Maximum	5	$55,000,000	100%	100%	5	5	5
	Average	2.2	$14,026,857	54%	46%	3.9	3.2	3.0

District	Engineer	Earthwork Quality	Earthwork Prod.	Bridge Deck Pour Quality	Bridge Deck Pour Prod.	ridge Deck Overle Quality	ridge Deck Overle Prod.	Struc. Bridge Wor Quality	Struc. Bridge Wor Prod.	oncrete Pavemen Quality	oncrete Pavemen Prod.	Asphalt Pavement Quality	Asphalt Pavement Prod.	Blasting Quality	Blasting Prod.	Drainage/Utilities Quality	Drainage/Utilities Prod.	Rock Excavation Quality	Rock Excavation Prod.	Striping Quality	Striping Prod.	Sign Placement Quality	Sign Placement Prod.	affic Control Syste Quality	affic Control Syste Prod.
2	Florence & Hutcheson	3	4	3	4									3	4			3	4					3	3
2	Larry Gayner			5	5	5	5					5	4			3	3			4	4			4	5
2	Jason Ward					4	4					5	5											4	4
3	Otis Rigsby			5	3	5	3					2	2					3	3					3	3
4	Josh Hornbeck	3	3	4	4	2	4						4												
5	Robert Harris	3	4	4	5	4	5	3	3	4	4	2	5			3	3			3	3	3	4		
5	Jamie King	3	3			4	2																		
6	Terry King					3	3																		
6	J. Peace			3	4			3	3							3	3			1	2	2	2		
6	Larry Stolz					4	5									5	5							5	5
7	Charlotte Feeth			3	2	3	2																	2	2
7	Sarah McNiel			4	3					4	4	2	3			4	4							3	3
7	Jake Stremmel	3	3	4	3							2	2					3	3						
8	Ronald Laugherty					3	3					4	3			4	3			2	3			2	2
9	Ed Broomell	3	4	3	3	3	3					3	3												
9	Paul Ford																								
9	Larry Taylor					5	5																		
10	Brian Billings	4	4			4	4											4	4						
10	Tony Bowling					3	3					3	3												
11	Phillip Howard	3	3	2	3	2	3											3	3	1	2			3	3
11	Robert Moore	3	3			3	3	3	3	3	5											3	3	3	3
12	George Collins	3	4	3	3	3	3					2	3					3	4	3	3				
12	Robin Justice			3	3																				
	Minimum	3	3	2	2	2	2	3	3	3	4	2	2	3	4	3	3	3	3	1	2	2	2	2	2
	Maximum	4	4	5	5	5	5	3	3	4	5	5	5	3	4	5	5	4	4	4	4	3	3	5	5
	Average	3.1	3.5	3.5	3.5	3.5	3.5	3.0	3.0	3.7	4.3	3.0	3.4	3.0	4.0	3.7	3.5	3.2	3.5	2.3	2.8	2.7	2.7	3.2	3.3

Additional Comments from Question 1

As a resident engineer, I do not control when the contractor works. However, certain projects are specified to be done at night mainly due to reduced traffic volumes. **Josh Hornbeck (4)**

Night work is either required by contract or contractor option. In my position, I do not have direct authority on requiring night work. **Robert Harris (5)**

It is obviously easier to perform certain major activities when traffic volumes are lighter. **Jamie King (5)**

Temperature concerns are the only reason construction may decide to work at night. Pre-construction/design sometimes mandate night work. **Terry King (6)**

Due to extremely high ADT's n district 6 much of the construction on main roads is being conducted at night solely for traffic flow concerns. **James Peace (6)**

I work in Boyle, Mercer, Garrard, and Anderson mainly and I don't have to deal with highly urban areas. Mainly my night work is due to temperature concerns—bridge deck overlays and bridge deck. **Charlotte Faeth (7)**

Since our primary counties are Fayette, Jessamine, and Woodford, any major work that will restrict traffic flow is mostly done at night. **Sarah McNiel (7)**

Low temperatures at night are favorable for concrete pours but not for asphalt placement (especially asphalt polymer mixes). **Jake Stremmel (7)**

Due to limited size of work area contractor's operations often interfere with each other. Temperature concerns was with concrete placement. Utility related work is often required by the utility owner. **Ron Laugherty (8)**

We do not have the high volume-urban traffic areas in Powell/Wolfe counties, therefore night time construction is usually only performed as a second shift on a roadway excavation project. **Brian Billings (10)**

Road user costs (Lane Rental). **Doug Neal (11)**

Addition Comments from Question 2

Employees worn out working long hours and quality sometimes suffers. Often overlaying bridges and generator required. Sometimes contractors do not adequately monitor generators and traffic lights. Jack hammers, concrete sawing, etc. done at night to reduce traffic interruptions cause irritation. **Larry Gayner (2)**

It should be specified the type of reflective vests are required to be worn at night. **Jason Hornbeck (4)**

It is harder to make sure motorists understand traffic control and noise seems to irritate some public. **Jamie King (5)**

Traffic seems to be moving faster late at night. **Terry King (6)**

Communications are especially difficult—the resident is usually working days and sometimes is unavailable to work nights, too. **Sarah McNiel (7)**

Quality and Production are especially low on interstate asphalt placement. **Jake Stremmel (7)**

The Project Engineer/Manager cannot be available 24 hours per day if expected problems arise. Lighting/safety is a major concern. **Ron Laugherty (8)**

My comment (see comment, question 1) refer to grade and drain construction where there is little or no traffic impact. **Brian Billings (10)**

Slight drop in quality of bituminous mat (longitudinal joint). **Tony Bowling (10)**

Poor visibility and fatigue are potential safety concerns. **Phillip Howard (11)**

Not enough lighting supplied at some times. **Doug Neal (11)**

What do you feel is the main advantage of performing work at night?

Decreases construction time. **Florence & Hutcheson, Inc. (2)**

In city pays with less disruption of traffic. Better quality control for paving and bridge overlays during high daytime temperatures. **Larry Gayner (2)**

Material delivery is quicker due to less traffic. Safer to work in traffic due to less traffic. Quality is better due to less traffic. Little impact to businesses in the area of construction. **Jason Ward (2)**

Cooler and no sunlight, both are needed for most bridge deck overlay work. **Otis Rigsby (3)**

Lower traffic volumes (easier to get materials to project). Traffic control easier to set up and maintain. **Josh Hornbeck (4)**

High volume commercial area keeps business disruption to a minimum. If area is heavily congested it improves material delivery. In some instances, reduced traffic volumes improve worker safety. **Robert Harris (5)**

Helps project progress. Decreases impact on traveling public. **Jamie King (5)**

Lower temperature for bridge deck overlay. **Terry King (6)**

Lower traffic volumes which are conducive to bringing material to the site. **James Peace (6)**

Obviously the temperatures are cooler at night (for concrete work) and also there is less traffic at night on many routes. **Charlotte Faeth (6)**

In the urban areas, there is less disruption during morning and evening rush hours traffic. Also allows longer work hours for lane closures i.e. daytime 9:00AM—3:00PM (6 hours) 9:00PM—6:00AM (9 hours). **Larry Stolz (6)**

I think the main advantage to working at night is the decrease in traffic volumes in the work area. Since the majority of our work occurs in urban areas, the less traffic, the better! Night work is also good during the hottest part of the summer because the contractor doesn't have to worry about the temperature limitations for hot weather. **Sarah McNiel (7)**

The main advantage is low traffic volume. This decreases delay and public user cost. **Jake Stremmel (7)**

During periods of high daytime temperatures placement of asphalt pavement and concrete structures (barrier wall, slope wall, bridge deck overlay, etc.) will result in a better product. A work area with limited available work space will necessitate the contractor's operations be performed at different times. **Ron Laugherty (8)**

Less traffic. Cooler Temperatures. **Ed Broomall (9)**

We have performed night work on 3 projects. These include bituminous paving on a major intersection, Portland cement inlay of intersections, and bridge deck overlays. Advantages include: 1. decreased traffic; 2. lower temperatures. **Paul Ford (9)**

Traffic Flow. **Larry Taylor (9)**

On grade and drain construction it allows the contractor to take advantage of moving earth during the night when their equipment would normally be sitting without being used. In areas of higher volumes of traffic it would seem much safer to perform resurfacing projects at night when traffic volumes are low as long as adequate lighting was available. **Brian Billings (10)**

Less Traffic. **Tony Bowling (10)**

Less impact and delays to traveling public. Cooler environment. **Phillip Howard (11)**

During summer months temperature for pouring PCCP-24 hr was an advantage. Less traffic volume. **Doug Neal (11)**

Productivity. **George Collins (12)**

Temperature for concrete work. Scheduling if a road is closed or detoured. **Robin Justice**

What do you feel is the main disadvantage of performing work at night?

Public Irritation. Personnel Scheduling. Employee Morale. **Florence & Hutcheson, Inc. (2)**

Fatigue. **Larry Gayner (2)**

It is more difficult to see especially with moving operations such as asphalt projects. It is physically harder on personnel who are used to working in the day. Equipment breakdowns are more difficult to fix and get parts with everything closed. More difficult to make decisions concerning the project if all the leadership is not present. **Jason Ward (2)**

Poor quality, especially asphalt pavement. **Otis Rigsby (3)**

Poor visibility. It is hard for motorists to see workers. It is hard for workers to see the product they are constructing. **Josh Hornbeck (4)**

Highly residential area brings many noise complaints. Asphalt mat can be left with roller marks due to insufficient light. Traveling public may be at some higher risks due to higher speeds with reduced volumes and their having to deal with traffic control. Work risk for same reason. Increased contract cost (maybe). Worker availability. **Robert Harris (5)**

Safety, productivity, and controlling perception of traffic. **Jamie King (5)**

Limited visibility and increase danger from fast moving tractor trailers. **Terry King (6)**

Safety. Quality of workmanship. Quality of inspection. Productivity. **James Peace (6)**

Visibility is poorer at night. When we do overlays and deck pours often the crews have worked day hours and then have little rest before getting up and doing evening or early

morning work. This decreases productivity and increases risk of accidents. **Charlotte Faeth (7)**

KyTC's problem is with scheduling personnel. Do not have enough personnel to staff projects to wrok both day and night shifts. Also an employee morale problem—no one likes working at night. **Larry Stolz (6)**

I believe the quality of the work suffers when the contractor works at night. The workmanship suffers due partially to the difficulty in receiving materials (like asphalt), but also because the employees do not usually want to work at night. **Sarah McNiel (7)**

The main disadvantage is the loss of quality. During pavement operations, lighting is critical for rideability of the pavement. Vibratory rollers do not get the roller marks out. Lower temperatures also cause asphalt to cool quicker ad make it less workable. **Jake Stremmel (7)**

Providing adequate lighted work area and safety concerns. Having someone on project to make immediate decisions regardless of any problems that may arise. **Ron Laugherty (8)**

If you have problems it is sometimes impossible to get information to make your best decision. **Ed Broomall (9)**

Productivity can be decreased. Lighting (for traffic control and for lighting work areas) can be a problem. Material delivery and equipment maintenance can be jeopardized. **Paul Ford (9)**

Safety. **Larry Taylor (9)**

Depending on the nature of the work and the area the work is being performs, noise could be a major concern. The only other major concern is safety to public and construction workers. Special considerations should be given to lighting and traffic control devices to ensure safety. **Brian Billings (10)**

Poor Lighting. **Tony Bowling (10)**

Poor quality—many times a problem in quality is not detected until the following day. Work force availability—currently there are not enough night shift applications for contractors to employ a full time night shift requiring day shift workers to either change their schedules on short notice of work two shifts. **Phillip Howard (11)**

Visibility and safety if inadequate lighting is supplied. **Doug Neal (11)**

Safety. **George Collins (12)**

Safety—employees cannot see well or are tired. Productivity can be reduced. **Robin Justice (12)**

Are their any additional comments you would like to make?

Other than bridge deck pours I have not been involved in night work since 1995 back to 1989 while working on the AA Highway in Northern and Eastern Kentucky. Blasting and excavation were the only operations active then. **Jack Smiddy (2)**

The asphalt project that was competed this year at night went very well and won the National Pavement Association's 1999 quality in construction award. The bridge deck overlays also went very well and quickly. **Jason Ward (2)**

With no pay incentives to work at night, most employees would prefer not to do it. **Terry King (6)**

I feel we should be very selective in the work performed at night due to the premiums paid for the work and inferior workmanship. Also considerations should be made for workman's safety. The increased volume of heavy truck traffic plus the increased speeds because of lower traffic volumes and reduced visibility make for very dangerous conditions for workers and the traveling public. **James Peace (6)**

Although night work is sometimes necessary, I think that for the most part construction work should be completed in daylight. The safety of the travelling public and the contractor is compromised at night, regardless of the traffic control devices. **Sarah McNiel (7)**

Night work is going to increase due to traffic concerns. Educating the public is necessary. **Paul Ford (9)**

I am glad to see a study such as this one. **Brian Billings (10)**

KyTC
Night Time Construction
Project Evaluation Form

Project: _____ Project No.: _____ District: _____

Form Completed By: _____

Position/Title: _____ Date: _____

Traffic Issues

Based upon a recent traffic analysis, what is the current *level of service* of the site during the day?

A	B	C	D	E	F	
0	1	2	3	4	5	_____

Based upon a recent traffic analysis, what would be the estimated *level of service* after a daytime lane closure?

A	B	C	D	E	F	
0	1	2	3	4	5	_____

Based upon a recent traffic analysis, what is the current *level of service* of the site during night-time?

F	E	D	C	B	A	
0	1	2	3	4	5	_____

Based upon a recent traffic analysis, what would be the estimated *level of service* after a night-time lane closure?

F	E	D	C	B	A	
0	1	2	3	4	5	_____

Traffic Issues Average: _____

Project: _____

Economic Issues

How will local businesses be impacted by day-work?

Low Impact		Moderate Impact		High Impact	
1	2	3	4	5	_____

How will local businesses be impacted by night-work?

High Impact		Moderate Impact		Low Impact	
1	2	3	4	5	_____

What is the estimated daytime road user cost of the construction site?

Low		Medium		High	
1	2	3	4	5	_____

Economic Issues Average: _____

Social Issues

What is the location (radius) of residential development (including churches, hospitals, etc.) in relation to the job site?

< ¼ mile	¼ - ½ mile	½ -1 mile	1-2 miles	> 2 miles	
1	2	3	4	5	_____

How will this development be affected by the following during night operations:

Lighting

Very Negative		Moderate		Low	
1	2	3	4	5	_____

Noise

Very Negative		Moderate		Low	
1	2	3	4	5	_____

Vibration

Very Negative		Moderate		Low	
1	2	3	4	5	_____

Traffic

Very Negative		Moderate		Low	
1	2	3	4	5	_____

Social Issues Average: _____

Project: _____

Construction Issues

How would performing this project at night affect:

Quality

Very Negative		No Effect		Very Positive	
1	2	3	4	5	_____

Schedule

Very Negative		No Effect		Very Positive	
1	2	3	4	5	_____

Cost

Very Negative		No Effect		Very Positive	
1	2	3	4	5	_____

Safety

Very Negative		No Effect		Very Positive	
1	2	3	4	5	_____

Construction Issues Average: _____

Other Issues

Are there any other operations, conditions, or special events that could affect the feasibility of night operations?

Very Negative		No Effect		Very Positive
1	2	3	4	5

Description

_____ _____

_____ _____

_____ _____

_____ _____

Other Issues Average: _____

Project: _____

Issues	Weight*	Rating	Weighted Rating
Traffic Issues			
Economic Issues			
Social Issues			
Construction Issues			
Other Issues			

100%

ΣTotal Weighted Rating: _____

Scale

4-5 Definite Candidate for Night-Time Construction

3-4 Good Candidate for Night-Time Construction

2-3 Marginal Candidate for Night-Time Construction

1-2 Poor Candidate for Night-Time Construction

*The standard weight for each category should be 20% unless the evaluator deems other weights more appropriate.