U.S.Department
of Transportation

Federal Highway Administration

Manual on Use of Self-Propelled Modular Transporters to Remove and Replace Bridges

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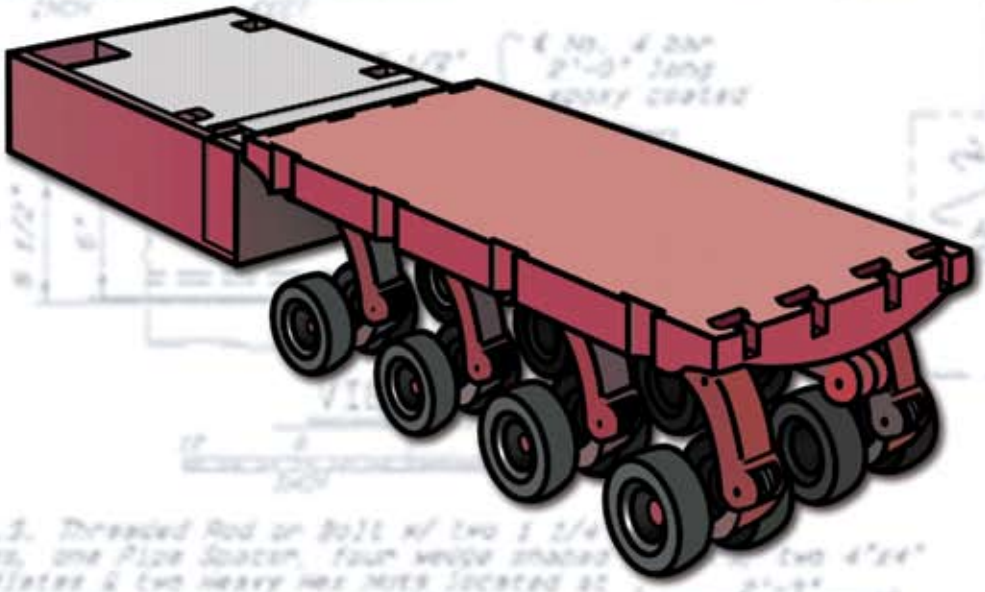

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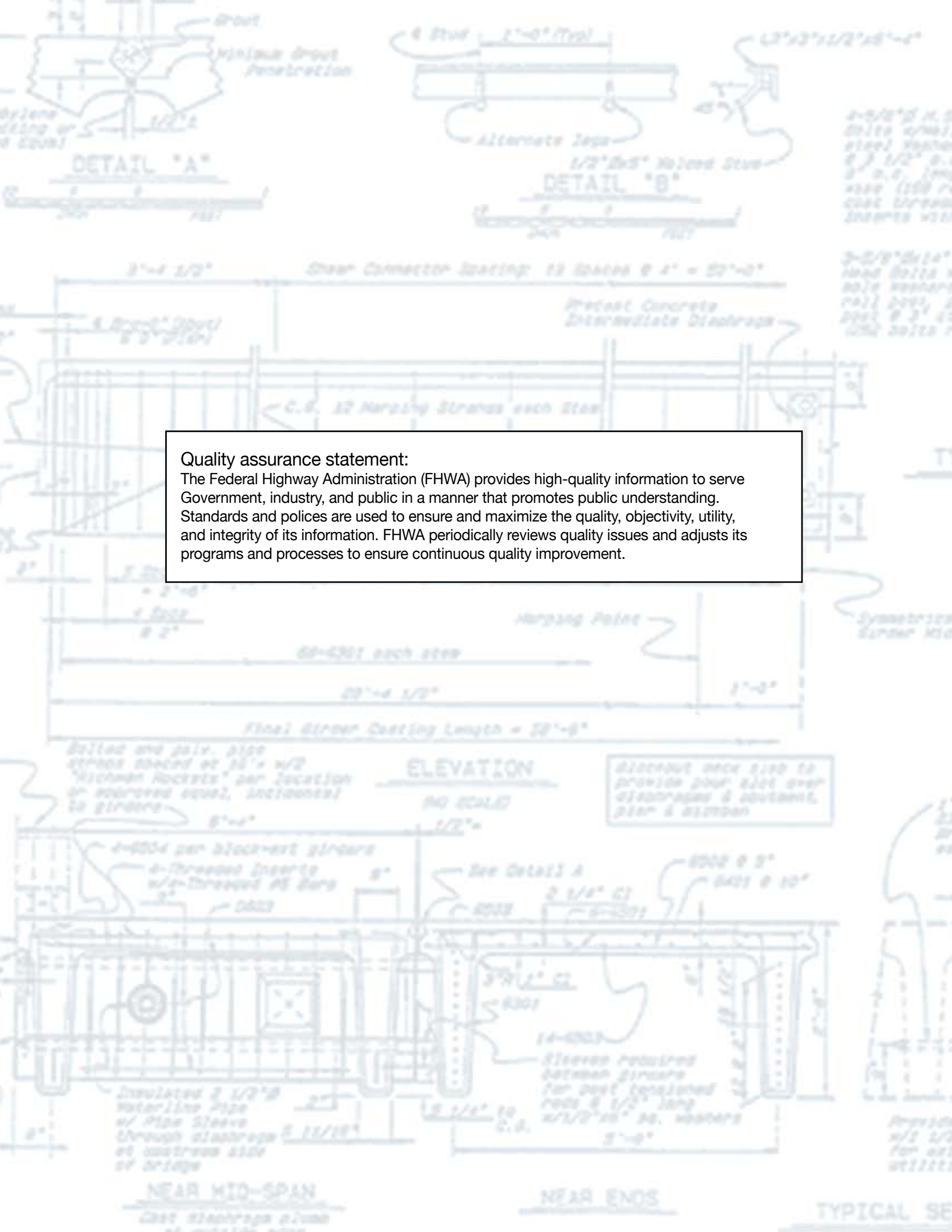

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Manual on Use of Self-Propelled Modular Transporters to Move Bridges

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Preface

This manual contains information on the equipment, benefits, costs, project selection criteria, planning, design, contracting issues, and example contract documents for using self-propelled modular transporters to move bridges. It also includes case studies and lessons learned from previous projects. The manual is intended for use by bridge owners, construction contractors, suppliers, and other professionals involved in bridge design and construction.

The development of this manual was sponsored by the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), the National Cooperative Highway Research Program (NCHRP), and the Florida Department of Transportation. The manual was requested as part of the Scan Technology Implementation Plan following the 2004 FHWA/AASHTO/NCHRP International Scan on Prefabricated Bridge Elements and Systems.

Executive Summary

The use of self-propelled modular transporters (SPMTs) for bridge moves was the top implementation recommendation of the 2004 Prefabricated Bridge Elements and Systems International Scan sponsored by the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), and the Transportation Research Board's National Cooperative Highway Research Program (NCHRP).

The purpose of the scan was to learn how other countries use prefabricated bridge components to minimize traffic disruption, improve work zone safety, reduce environmental impact, improve constructability, enhance quality, and lower life-cycle costs. The scan team learned that European countries frequently use SPMTs to lift and drive bridges to their final location in just minutes.

SPMTs are computer-controlled platform vehicles that can move bridge systems weighing up to several thousand tons with precision to within a fraction of an inch. The prefabrication of bridges offsite under controlled conditions followed by rapid installation onsite can achieve quality installations with traffic impacts of minutes to a few hours compared to the months typically required for conventional onsite bridge construction.

The significantly reduced onsite construction time when using SPMTs to move prefabricated bridge superstructures, for example, is due to the collapse of the sequential processes of conventional onsite bridge construction to just one step: moving the prefabricated superstructure from the staging area to its final position. This technology should be considered for all bridge replacement projects where reduced onsite construction time is a priority.

The manual provides details from project conception to completion for using SPMTs to remove or install a bridge. It describes equipment, lists benefits and costs, and identifies criteria to determine when this technology is appropriate. It also addresses planning-related issues such as traffic considerations and site requirements. Design issues discussed include temporary shoring and prefabrication requirements, allowable temporary stresses and deflections during the move, and possible design efficiencies because of offsite prefabrication.

Contracting issues covered include staging area requirements and contracting strategies for reduced onsite construction time. Also included are various example calculations, diagrams, plan sheets, and specifications for use as a starting point for upcoming projects using SPMTs to remove or install bridges. Case studies of bridges moved with SPMTs are also included; the 2006 Florida Department of Transportation I-4/Graves Avenue bridge replacement project is covered in detail, and several other projects are summarized.

Using this manual in combination with the FHWA decisionmaking framework and analysis of delay-related user costs should provide the guidance that bridge owners and other bridge professionals need to understand the technology, determine whether using SPMTs will benefit a specific bridge project, and develop contract documents that incorporate the technology.

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Chapter 1. Introduction

1.1 Background

The use of self-propelled modular transporters (SPMTs) for bridge moves was the top implementation recommendation of the 2004 Prefabricated Bridge Elements and Systems International Scan sponsored by the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), and the Transportation Research Board's National Cooperative Highway Research Program.[1,2] The purpose of the scan was to learn how other countries use prefabricated bridge components to minimize traffic disruption, improve work zone safety, reduce environmental impact, improve constructability, enhance quality, and lower life-cycle costs.

Prefabrication of bridges offsite under more controlled conditions followed by rapid installation onsite can achieve quality installations in significantly less time than the months or years typically required for conventional bridge construction. The use of SPMTs in combination with prefabrication should be considered for all bridge replacement projects in locations with high traffic volumes, such as those with 40,000 or more vehicles per day either on the bridge or on the roadway below the bridge. Other factors mentioned above may also make the use of SPMTs the best choice for the project.

The sequential processes of conventional onsite bridge superstructure construction include the following:
- Erecting beams
- Erecting stay-in-place or temporary deck forms and overhang forms
- Installing shear studs on steel girders
- Tying deck reinforcement
- Placing deck concrete
- Curing deck concrete
- Removing temporary formwork
- Placing barriers and appurtenances such as light poles, screens, and signs

With SPMT technology, the conventional sequence is reduced to one step: Move the prefabricated bridge superstructure to its final position.

The significant construction time savings from using SPMTs to install prefabricated bridges are due to the change from the sequential processes of conventional bridge construction to concurrent processes, followed by the use of SPMTs to quickly install the bridge:

- Prefabrication can begin well before site preparation has been completed. A replacement bridge can be built at a nearby staging area that does not impact the traveling public, at a lower elevation for improved construction safety, and on a timeline that allows attention to details such as proper concrete deck curing to achieve good long-term performance.

- The demolition process is significantly improved. It is not necessary to construct shielding to protect traffic under the bridge, saving time and money and reducing the need for road closure. Danger to traffic below from debris falling off or through the shielding is eliminated. Quick removal of the existing bridge using SPMTs followed by demolition at a staging area speed onsite construction compared to the incremental onsite demolition of conventional construction projects. SPMTs may be used for removal only on a project, or to both remove the existing bridge and install the new bridge.

- The prefabricated bridge can be ready to install as soon as the site has been prepared. SPMTs can move the new bridge superstructure or complete bridge into place in minutes, with construction inspection completed and traffic flow restored within several hours.

SPMTs can also move multispan superstructures and bridges complete with substructures, further reducing onsite construction time. Both concrete bridges and steel bridges can be moved with SPMTs.

1.2 Description of Equipment

SPMTs are computer-controlled platform vehicles used extensively in Europe to lift and drive components of the petrochemical, offshore, power, and heavy civil engineering industries. The shipbuilding industry uses SPMTs to move ship components during fabrication and the transportation industry uses them to move bridges. SPMTs move bridge systems weighing from 165 to 3,600 tons (149.6 to 3,265.8 metric tons) with precision to within a fraction of an inch.

A single SPMT unit has either six- or four-axle lines, with each axle line consisting of multiple wheels arranged in pairs and spaced at a maximum 5 feet (ft) (1.5 meters (m)). Six-axle units are shown in figures 1(a) and 1(b) (see next page). The units can be rigidly coupled longitudinally and laterally to combine several units, as shown in figure 1(c), for synchronized movement of all axles. The units are connected by a cable and controlled by one driver who operates the controller while walking with the units. If the computer malfunctions, the SPMTs under each span end can still operate, but with operators manually coordinating to ensure their numbers are the same. Two operators are also used when a span is being set because the span ends are set independently.

The term “SPMT” is somewhat generic in the market, and there are self-driven units limited to only 60 degrees. This manual, however, concerns SPMTs with electronic steering capability that allows 360-degree pivoting about a point. The controller has four basic commands: steer, lift, drive, and brake. The computerized electronic steering capability allows movement in any horizontal direction: straight forward and backward, transversely, diagonally, and at any angle as well as carousel steering. Each pair of wheels can pivot 360 degrees about its support point. Loaded SPMTs typically travel at a walking pace of 3 miles per hour (mi/h) (4.8 kilometers per hour (km/h)) or 4.4 feet per second (ft/s) (1.3 meters per second (m/s)) and can travel up to 7 mi/h (11.2 km/h) or 10 ft/s (3 m/s), depending on load and terrain.

A four-axle SPMT unit is about 20 ft (6 m) long without the powerpack unit; a six-axle unit is about 30 ft (9.1 m) long without the powerpack unit. The powerpack unit adds another 13 to 14 ft (3.9 to 4.2 m) to the length of each unit. SPMTs can be transported to the bridge site on normal flatbed trailers or shipped in flat rack containers. For highway transport, the six-axle units require overweight permits and the 10-ft (3-m) wide units require permits for both width and weight.

Each SPMT unit is 8 ft (2.4 m) wide with four wheels per axle line or 10 ft (3 m) wide with eight wheels per axle line. Capacity and lift range vary by manufacturer, configuration type (e.g., unit width), and ground conditions.

The top surface of the unloaded SPMT platform at its lowest position is at most 4 ft (1.2 m) from the ground surface. Factors such as magnitude of load, tire compression, platform camber, and ground surface variation along the travel path affect the loaded SPMT platform travel height. The preferred minimum

platform travel height is 44 to 60 inches (in) (111.7 to 152.4 centimeters (cm)), but the platform height may be as low as 36 to 50 in (91.4 to 127 cm) during travel.

Figure 1(a). SPMT six-axle unit, 8 ft (2.4 m) wide.

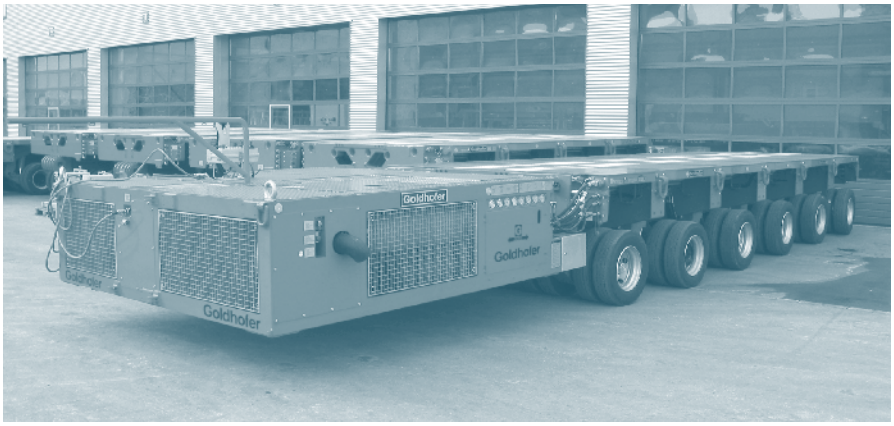


Figure 1(b). SPMT six-axle unit, 10 ft (3 m) wide.

Figure 1(c). SPMT units coupled longitudinally and laterally.

The minimum available vertical stroke of the SPMT platform is about 24 in (60.9 cm), and the vertical lift range is about 36 to 60 in (91.4 to 152.4 cm). An available vertical stroke of 16 to 20 in (40.6 to 50.8 cm) should be assumed for operational purposes.

The SPMT platform can be vertically adjusted up to 24 in (60.9 cm) to keep the load horizontal without distortion while traversing uneven and sloping ground surfaces. SPMTs can travel on uneven terrain with surface variations up to 18 in (45.7 cm) and on grades up to 8 percent, depending on ground surface friction. Equipment for vertical lifting can be mounted on the SPMT platform as needed. Equal loads are maintained on each axle line through the SPMT's three-point or four-point hydraulic suspension system, which consists of two hydraulic rams per axle line with each ram attached to a hinged elbow supported by two wheels. If the ground settles during a bridge move, the hydraulic system compensates for the height difference.

A set of SPMT units under a lift point can be connected transversely to a set of SPMT units under a second lift point through the installation of connecting cross-frames. This may be required to minimize differential movement between the points.

Each axle line has a maximum applied-load capacity of 26 to 33 tons (24 to 30 metric tons), depending on unit width, and exerts a maximum ground pressure of 1,500 to 2,000 pounds per square foot (7,323.6 to 9,764.8 kilogram-force per square meter), depending on magnitude of load. The maximum load per axle line is not always possible, however, because the heavy loads being transported can create excessively high ground bearing pressures. In such cases, additional SPMT units may be required to reduce the bearing pressure to an allowable level. Steel plates can also be placed along the travel path to help spread the loads. The maximum load per axle line may also not be possible when loads have a high centroid of gravity. In such cases, additional SPMT units may be required if cross-frames connecting the units are not sufficient to ensure stability.

The SPMTs will have blocking on top of their platforms to support all the beams in the span. For bridge removals, the SPMT units will be assembled, blocking will be placed on top of the SPMT platforms, the SPMTs will drive under the span and lift it using their hydraulic system, the loaded SPMTs will travel at a normal walking pace to the staging area, and the SPMTs will incrementally lower the span onto temporary blocking for demolition. A similar process in the reverse order is used to move a new bridge into place.

1.3 Equipment Availability and Services

As part of the 2004 scan, the scan team visited two SPMT companies. These worldwide specialists in heavy and complex lifting and transport are Mammoet, a member of the Van Seumeren Group headquartered in the Netherlands (www.mammoet.com), and the Sarens Group, headquartered in Belgium (www.sarens.com). SPMTs are part of the extensive equipment inventory of both companies. Mammoet has 2,200 axle lines of SPMTs; Sarens has 500 axle lines. The approximate cost of one axle line is $150,000.

Mammoet has offices in the United States and has done most of the U.S. bridge moves. Sarens has operations in the United States and has recently entered the U.S. bridge market. Barnhart Crane & Rigging Company (http://barnhartcrane.com), a U.S. company with offices in a number of States, has recently purchased 108 SPMT units and has expressed significant interest in the U.S. bridge market. Other U.S. companies that own and operate SPMTs include S.G. Marino Crane Service Corporation

(http://www.marinocrane.com), headquartered in Middletown, CT, and Bigge Crane & Rigging Co. (http://www. bigge.com), headquartered in San Leandro, CA. For large moves, these companies may lease SPMTs from each other to reduce the cost of the move. By doing this, each company does not need to own large quantities of machinery that lay idle. The more the industry maximizes the use of the equipment, the lower the net cost.

These SPMT companies are more than equipment suppliers. They have engineering departments that develop detailed moving plans. In bridge projects in the United States to date, the SPMT company typically has been a subcontractor to the general contractor that is awarded the project. On larger or more complex projects, the SPMT company is typically a subcontractor to the bridge subcontractor to the general contractor that is awarded the project.

The SPMT company handles the details of the actual move, including engineering, site surveys, crew and equipment scheduling, equipment assembly operations, transport route, and logistics plans that minimize traffic disruption.

An example of the engineering services SPMT companies provide is the design and engineering of temporary supports for the move. The companies have various systems to lift and support the loads before and during the move. For example, Mammoet has its Titan Bridge Lift System (see figure 2(a)), climbing jack system (see figure 2(b)), and container support system (see figure 2(c)). A strand jack system may be used for larger, taller moves (see figure 2(d)). The engineering services of these companies include determining which system is best considering mobilization cost and weight and height of the load.

Figure 2(a). Titan Bridge Lift System.

Figure 2(b). Climbing jack system.

Figure 2(c). Container support system.

Figure 2(d). Strand jack system.

Mammoet's Titan Bridge Lift System was designed to install large prefabricated bridge spans, remove old bridges, and realign existing bridges by moving them horizontally or vertically. The lifting system is composed of modular steel "stools," each ranging in height from 16 in (40.6 cm) to 4 ft (1.2 m). The stools sit atop the SPMT platform. The SPMT hydraulic suspension system provides the lifting force for the Titan towers, and the stools are inserted incrementally. The process is repeated until the bridge is at the desired height.

Another example of the SPMT companies' engineering services is the design and engineering of temporary substructures used to support superstructures at their staging area before they are moved to their final locations. The Sarens Group has designed a standardized system of temporary substructures that are adaptable for their various bridge projects. An example of Sarens' standardized temporary substructure is shown in figure 3 (see next page).

Figure 3. Substructure for temporary bridge support for Nootdorp Bridge in the Netherlands.

SPMT companies can also provide special framing systems to use in conjunction with SPMTs to address the needs of the bridge move. For example, for the Washington State Department of Transportation (WSDOT) Lewis and Clark Bridge deck replacement project (see 7.1.5 in "Case Studies"), Mammoet developed a special framing system to carry the full-width, full-depth deck panels. Another example is Barnhart's gantry system that can be used with SPMTs to remove and replace bridge spans over roadways or rail lines while providing minimal interruption to service.

1.4 List of Example Calculations, Diagrams, Plan Sheets, and Specifications

A number of example calculations, diagrams, plan sheet details, and specifications are included in this manual to use as a starting point for projects using SPMTs to move bridges. Below is a list of those examples, in the order of their location in the text.

3.2.2 Contracting Strategies and Delay-Related User Costs

- An example user cost spreadsheet is in Appendix A.

4.4.1 Decks

- Example plan sheet details for a cast-in-place deck closure pour option to facilitate span fit-up are in Appendix B.

4.9.1.2 Use of Lightweight Aggregate

- Example calculations for comparing the total bridge weight and estimated cost premium for a bridge with normal-weight concrete and lightweight concrete are in Appendix C.

6.1 SPMT Equipment Requirements

- An example specification for SPMT equipment is in Appendix D.

6.2 Alternative Bridge Installation With SPMTs

- Wording for an alternative bridge installation method using SPMTs is on the example contractor alternatives plan sheet in Appendix E.

6.3 Alternative Superstructure Design to Reduce Dead Load

- Wording for an alternative composite dead load bridge design to be used in conjunction with SPMTs is on the example contractor alternatives plan sheet in Appendix E.
- An example of wording for the lightweight concrete option that can be added to the contractor alternatives plan sheet in Appendix E is as follows:

  Lightweight concrete may be used for any or all superstructure elements.
  Lightweight concrete shall conform to the Standard Specifications.
- An example specification for lightweight concrete is in Appendix F.

6.4.1 Incentive/Disincentive

- An example incentive/disincentive specification used in conjunction with the contractor alternatives plan sheet in Appendix E is in Appendix G.
- Examples of other boilerplate incentive/disincentive specifications are in Appendix H.

6.4.2 Bonus

- An example bonus specification used in conjunction with the contractor alternatives plan sheet in Appendix E is in Appendix G.
- Examples of other boilerplate bonus specifications are in Appendix I.

6.4.3 Lane Rental

- Examples of lane rental specifications are in Appendix J.

6.5 Value Engineering

- An example value engineering specification is in Appendix K.

6.6 Partnering

- An example partnering specification is in Appendix L.

6.7 Traffic Control Plans

- An example listing of general notes for traffic control are in Appendix M, with the two modifications for SPMT methods shown in bold.
- An example traffic control plan sheet for rolling roadblocks used for conventional bridge demolition is in Appendix M (see “I-4 Pacing Operation General Notes”). Only one rolling roadblock is required when SPMTs are used to remove an entire span, instead of conventional demolition in which a rolling roadblock is required for each beam removal.
- An example traffic control plan for a temporary bridge closure when SPMTs were used to replace spans of a bridge crossing a highway is in Appendix M (see “I-4 Closure Detail”).

6.8.1 Temporary Shoring Bents Founded on Shallow Foundations—Differential Settlement

- An example specification for a temporary shoring on shallow foundations settlement report is in Appendix N.

6.9 Movement Plan

- Examples of path and motion diagrams are in Appendix O.

Chapter 2. Benefits and Costs

2.1 Impacts of Conventional Construction

Removing and replacing a bridge on its original horizontal alignment using conventional methods typically requires closing the bridge to traffic for 6 months to more than a year, diverting traffic that previously used the bridge to a detour route during that time. The traffic that passes underneath a typical bridge during conventional construction is also disrupted with multiple rolling roadblocks, numerous lane closures, and crossovers during the extended onsite construction period. Conventional in-place demolition of an existing bridge that crosses a high-traffic-volume roadway is typically done at night to limit traffic disruption, with restrictions on hours of work, for example, from 10 p.m. to 6 a.m., further reducing the contractor's production.

2.2 Benefits of SPMT Bridge Moves

The ability of SPMT technology to move bridges in minutes or hours can significantly reduce traffic disruption, restore the use of existing highways in significantly less time, improve work zone safety, minimize environmental impact, improve constructability, and lower life-cycle costs. Particularly attractive are the reduced onsite construction time, improved quality of construction, and increased contractor options that are possible when SMPTs are used to move new prefabricated bridges into position.

2.2.1 Reduced Onsite Construction Time

Using SPMTs to install bridges offers the shortest possible onsite construction time. Disruption to traffic using a bridge under construction and a highway crossing underneath the bridge can be decreased from months to minutes or hours. The decreased onsite construction time also improves work zone safety for both motorists and construction crews. Access to schools and hospitals and access by emergency response services are also affected less with reduced onsite construction time. In addition, shorter construction times improve public perception of service.

2.2.2 Improved Quality of Construction

Improved quality with longer service life and reduced maintenance can be achieved in prefabricated bridge systems built offsite and quickly moved into position with SPMTs. Quality is enhanced for several reasons. First, the bridges are built in the controlled conditions of the staging area, allowing continuous operations without the need to accommodate traffic. Second, the bridge can be built as a unit in the staging area and moved as a unit to the bridge site, reducing the number of deck joints typically required in prefabricated bridge systems. Bridge owners in Europe have demonstrated this with their multiple-span continuous bridges, both with and without substructures, constructed offsite and moved into final position with SPMTs. Third, work can begin early in the staging area, independent of onsite construction status, allowing adequate time for proper construction of the system and proper curing of the concrete to ensure good long-term performance. These advantages can lead to improved reliability in achieving the desired 100-year service life compared to conventional construction.

2.2.3 Increased Contractor Options

The SPMT driving method increases the contractor's options. Its use allows the new bridge to be assembled at an offsite location and quickly driven in any direction to its final location. Precision movement to position the bridge within a fraction of an inch is possible with SPMTs. Driving also eliminates many of the issues related to overhead height restrictions that impact crane lifting

operations, and the supported SPMT loads provide added safety assurance relative to suspended crane loads.

Benefits to contractors also include being able to use conventional construction methods to build spans at staging areas near the installation site. The contractor further benefits from the flexibility of being able to work on the bridge as many hours as needed during the day, as well as from the improved safety and reduced risks of working at a lower height away from traffic. In addition, since foundation and possibly substructure work is being done onsite concurrently with prefabricated construction activities at the near-site staging area, an onsite delay (for example, because of unexpected utilities) will not impact construction at the staging area. Also, since more of the work is done offsite, fewer workers are required over or near traffic, further enhancing safety. Fewer and shorter lane closures also improve safety since any deviation from normal traffic patterns can result in accidents.

2.3 Costs of SPMT Bridge Moves

2.3.1 Initial Construction Costs

Total initial cost for using SPMTs can range from $50,000 to more than $500,000, depending on the location and requirements of the job; see 7.1 and 7.2 in "Case Studies" for cost breakdowns on two projects. While using SPMTs requires significant mobilization costs to get the equipment to the site and set up, substantial offsetting savings can be obtained by their use on a project. The cost for using SPMTs should be weighed against these savings to determine the net cost increase or reduction.

Initial cost savings that can result from using SPMTs to quickly move bridges include reduced costs because of fewer maintenance-of-traffic setups, shorter hours for off-duty law enforcement officers required for fewer rolling roadblocks, reduced switching of manpower from day to night (typically saving two hours per night shift plus gaining back the day/night/day shift change loss of the next day), and elimination of double handling and permits required to haul off the old beams.

Savings are also obtained through elimination of the need to build, maintain, or repair a detour or temporary structure that could otherwise be required for an extended closure period. Savings can also be obtained by delivering accelerated construction projects using a smaller owner and contractor workforce. Cost savings not reflected in the bid price include savings related to the owner's reduced construction engineering and inspection requirements because of the accelerated construction schedule.

Contractors are also recognizing initial cost savings through reducing overhead, labor, and equipment costs; reducing liability insurance premiums and equipment rental time; and completing projects quickly and bidding more projects without having to exceed their bonding limits. The incentives that can be made and the increased number of projects possible because of the speed of installation can also result in increased contractor profits compared to profits made through conventional construction methods.

Cost savings during the service life of the bridge should also be considered. The improved quality possible with this method can result in better long-term performance and reduced maintenance needs.

See the "7.1.1 I-4/Graves Avenue" case study for construction cost numbers for that project.

2.3.2 Delay-Related User Costs

Bridge closures, lane closures, detours, rolling roadblocks, and their resultant traffic buildups and

stoppages wreak havoc on reliable travel times. When delay-related user costs are included in cost analyses for moderate and high traffic volume locations, accelerated construction projects are always the best-value solution.

Significant reductions in delay-related user costs can be achieved using SPMTs to move bridges. No other technology offers shorter onsite construction times than can be achieved with the use of SPMTs to move prefabricated bridges.

See the “7.1.1 I-4/Graves Avenue” case study for delay-related user cost numbers for that project.

Chapter 3. Planning

The owner should design the project for the SPMT driving installation method to ensure the most efficient and cost-effective use of SPMTs to move bridges. The contract documents, however, may be developed for a conventional construction method, with additional wording that allows an alternative bridge installation method. This additional wording in combination with incentives and disincentives for early and late completion, respectively, and other contracting strategies for accelerated construction can be alternative means of achieving the owner's reduced construction timeline.

Suppliers of SPMT equipment and related engineering services should be included in discussions from the initial planning stages of a bridge project. Their inclusion will facilitate the development of contract plans and specifications that address the necessary details related to bridge movements to ensure successful projects and a cost-effective approach. If Federal funds are included in the project, the SPMT company that works with the owner in the planning stage will not be allowed to bid on the project because of Federal regulations on fair trade practices unless all SPMT companies are invited to participate in the discussions.

3.1 Project Selection Criteria

Using SPMTs to remove or install a bridge may be advantageous for a variety of reasons. Two primary criteria for initial consideration of SPMTs are the following:

- Need for minimal closure time to limit traffic disruption. The need for rapid onsite construction to get the bridge or the underneath roadway back in service to limit traffic disruption is a primary criterion for the use of SPMTs because their use provides the least possible closure time.
- Availability of a location for offsite bridge construction. The use of SPMTs requires a staging area for offsite construction of the bridge. A feasible route from the site to the bridge location must also be available.

Project conditions that make SPMT technology attractive are the following:

- The bridge or underneath roadway has high traffic volume.
- The bridge or underneath roadway is on an emergency evacuation route.
- The bridge is over a railroad or navigable waterway.
- Schools or hospitals are accessed via the bridge or underneath roadway.
- Commerce is negatively impacted by the construction.
- Overhead or adjacent work space constraints such as power lines or hurricane barriers prevent the use of conventional construction with cranes.
- Air or noise quality constraints limit the type or timing of construction activities.
- Endangered species on the site limit the timeline for construction activities.
- Weather constraints such as cold weather limit the length of time for construction activities.

Using SPMTs requires significant mobilization costs to get the equipment to the site and set up for bridge moves. The cost of using SPMTs should be weighed against the reduced costs that result from the significantly reduced onsite construction time to obtain an accurate net cost increase or decrease. Owners considering the use of SPMTs on a project should discuss cost implications with their local contractors during the planning process.

A decisionmaking framework on the FHWA Web site (www.fhwa.dot.gov/bridge/prefab/) can assist owners

in determining whether prefabricated bridges will benefit their specific project.[3] The framework discusses the many issues that may make prefabricated construction the solution of choice.

Using the decisionmaking framework and this manual in combination with analysis of delay-related user costs should provide the guidance that bridge owners and other bridge professionals need to understand the technology, determine whether using SPMTs will benefit a specific bridge project, and develop contract documents that incorporate the technology.

3.2 Traffic Considerations

High traffic volumes, for example, 40,000 or more vehicles per day, may justify the use of SPMTs to quickly move bridges. The impact of detours, lane closures, rolling roadblocks, and crossovers on traffic flow should be considered. The high traffic volumes may be crossing the bridge being replaced or traveling underneath.

The owner should develop contracting strategies and traffic control plans that are consistent with the traffic control windows and construction scheme in the contract documents. The dates and time limits for bridge closure windows should be clearly specified in the contract.

3.2.1 Traffic Impact Comparison Between Conventional and SPMT Construction

The following bridge construction activities are not allowed over active traffic:

- Bridge demolition
- Beam erection
- Deck form erection and removal
- Concrete deck pouring operations

Bridge demolition and beam erection typically require full closure of the underneath roadway. For conventional construction, deck form erection and removal and concrete deck pouring operations typically require traffic to be moved from underneath these operations using lane shifts, lane closures, or both. Lane closure restrictions for a specific site may require construction operations to be performed only at night, increasing labor and traffic control costs and decreasing production rates.

Table 1 (see next page) compares traffic impact of conventional construction methods to SPMT construction methods for bridge demolition and beam/span placement. Deck form erection and removal and concrete deck pouring operations require additional traffic impact for conventional construction; no traffic impact results from these operations with SPMT construction methods because they are performed at the staging area away from traffic.

Table 1. Traffic impact comparison of conventional and SPMT construction methods.

Table 1(a). *Typical traffic impacts using conventional construction methods.*

Construction Operation	Duration of Traffic Impact	Traffic Control Scheme
Bridge demolition	2–3 days per span removed	Traffic detour, Interstate crossover
Beam placement	Simple-span beam: 25–30 minutes per beam placed	Traffic detour, Interstate crossover or rolling roadblock
	Continuous steel: 45–90 minutes per field section placed and bolted	Traffic detour, Interstate crossover

Table 1(b). *Typical traffic impacts using SPMT construction methods.*

Construction Operation	Duration of Traffic Impact	Traffic Control Scheme
Bridge demolition	25-30 minutes per span removed	Traffic detour, Interstate crossover, rolling roadblocks
Span placement	Simple span: 2-3 hours per span placed	Traffic detour, Interstate crossover
	Continuous steel span: 2-3 hours per unit placed	Traffic detour, Interstate crossover

3.2.2 Contracting Strategies and Delay-Related User Costs

During the planning process the owner should determine contracting strategies that will encourage bid competition. For example, the incentives/disincentives should be large enough to make the offsite fabrication and move an attractive option to the contractor and give the contractor a financial reason to buy in to the owner's reduced construction timeline.

Delay-related user costs should be calculated to determine appropriate funding levels for contracting strategies. Owners use various user cost models. The Florida Department of Transportation (FDOT) uses a modification of the Arizona Department of Transportation (ADOT) user cost model.[4] An example user cost spreadsheet is in Appendix A.

3.3 Site Requirements

Sufficient land area (staging area) for bridge assembly should be available for SPMT construction methods. The staging area should be within a suitable distance from the bridge site. A feasible path must be available from the staging area to the bridge site, or from the staging area to barges that can go to the bridge site.

The ground surface at the staging area and along the path should be relatively flat and have adequate ground bearing capacity or steel plates provided to resist the loads.

3.4 Efficient Use of SPMTs

SPMT mobilization and remobilization costs can be significant. The scheduling of construction activities should provide efficient use of SPMTs to minimize their downtime on the project and the length of time they are required for the project.

Many bridge replacement projects along high-volume roadways require phased construction because of right-of-way costs, requiring remobilization of the SPMTs to place the second-phase bridge. Concepts that allow use of the SPMTs for other nonuser-critical spans on the project can help pay for their mobilization costs and other costs such as temporary shoring for composite dead load systems. For example, the SPMTs could be used to remove other bridges that will be replaced on the project but are not on the critical path.

3.5 Project Staffing

The delineation of responsibilities among the owner, the contractor, and the contractor's subcontractors (for example, the SPMT company) should minimize project risk by assigning each task to the party most capable of handling it successfully. Doing so reduces the potential liability of all parties and helps ensure a successful project.

All parties in the project should have an adequate understanding of the overall project and their roles to successfully complete the project. Responsibilities of each party must be clearly defined, including where each responsibility begins and ends.

Personnel responsibilities include the following:

- Owner—Provides qualified staff empowered to make prompt decisions and be available during all active hours of contractor work.
- Contractor—Provides qualified engineering and construction staff for the required services related to removing existing bridges and prefabricating, lifting, moving, and erecting new bridges.
- SPMT company—Provides qualified engineering and construction staff for the required services that are the SPMT company's responsibility related to removing existing bridges and lifting, moving, and erecting new bridges.

The owner should consider prequalification of contractors and SPMT companies to ensure that qualified staff members are available for the project.

3.6 Coordination with Other Entities

Coordination with other entities should begin as early in the project as possible to avoid delays to bridge moves. Activities should be initiated to ensure that at least one feasible staging area is available and to obtain required permits early (for example, U.S. Coast Guard permits for transport in navigable waters). Other coordination needs may include railroad agreements and utility relocations.

3.7 Outreach and Communication

Communication with the public should begin in the early planning stages of the project to ensure understanding of the impact on traffic during construction.

The owner's public relations staff will take the lead for media relations activities related to the project, such as disseminating news releases. Its district construction staff will control any public tours of the project, including arranging a safe area for viewing and issuing instructions/announcements at the jobsite. If the bridge moves are the State's first, the State bridge engineer should be approached about holding a demonstration workshop in conjunction with the moves.

The owner may choose to set up cameras for time-lapse photos or use nearby traffic management cameras if available. The owner may also hire a roaming videographer to document the bridge moves, maintaining ownership of all film rights and possibly producing clips for postevent release.

3.8 Contingency Plans

The contractor should have contingency plans for unplanned incidents, including backup equipment in case of mechanical failure and a reserve detour route for extended closures. The SPMT company should anticipate out-of-service conditions such as flats and failures and develop contingency plans accordingly to ensure that the operator can manually coordinate the SPMT units as needed to complete the bridge move.

Chapter 4. Design

4.1 Design Assumptions

Design assumptions used to develop project details include the following:

- Built-in-place substructures are constructed within tolerances to allow placement of the superstructure with adequate clearance.
- Actual lifting points for the move are the same as shown in the lifting diagrams the contractor submitted and the owners approved.

4.2 Ground Bearing Capacity

The contractor must prepare the ground for adequate bearing at the staging area for construction of the bridge on temporary supports, and along the path from the staging area to the final bridge location to resist the weight of the loaded SPMTs. Relationship between ground pressure and base preparation is shown in figure 4.

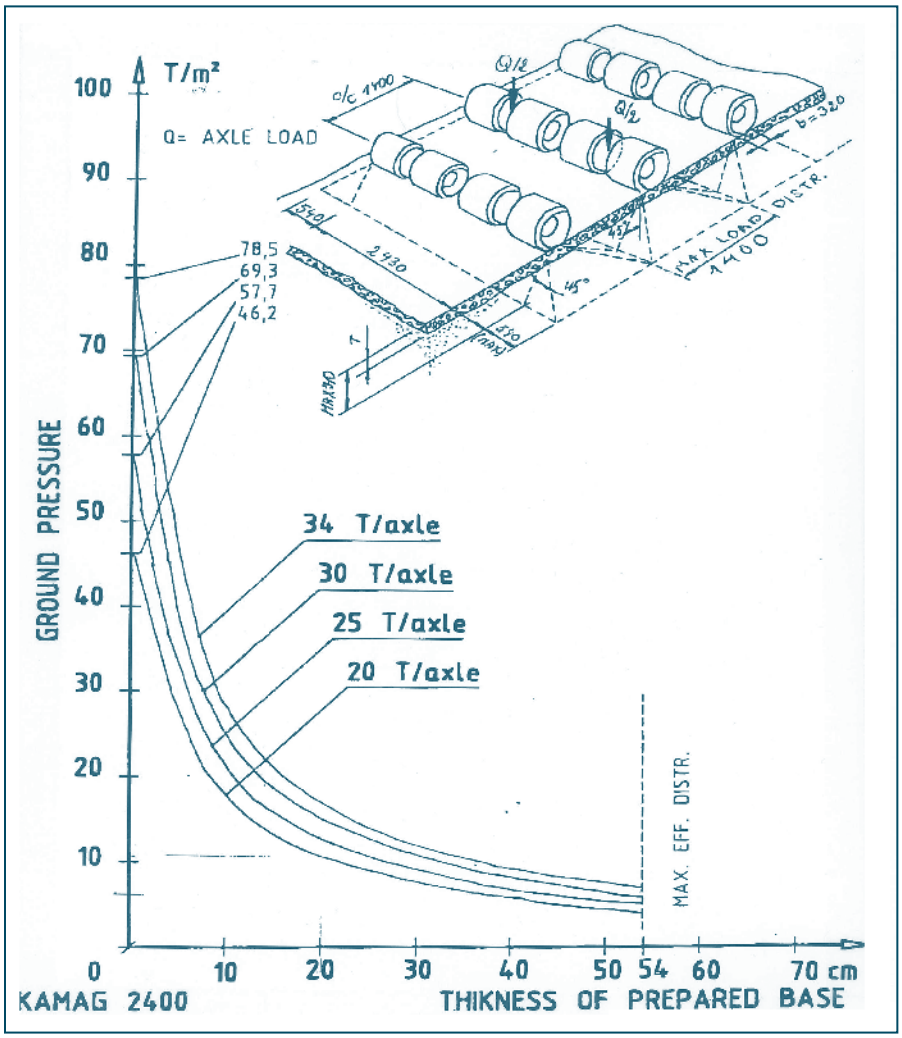


Figure 4. Relationship between ground pressure and base preparation. COURTESY OF SARENS GROUP

4.3 Temporary Shoring Bents at Staging Area

The temporary shoring bents (supports) should be designed using the AASHTO *Guide Design Specifications for Bridge Temporary Works*. Elevation tolerances should be specified.

The temporary supports must provide equal load distribution among beams and have adequate foundation capacity to prevent settlement before, during, and after construction of the superstructure. Monitoring should be in place to detect settlement.

The distance between temporary supports must be the same as between the final substructures. The caps of temporary supports will be constructed with beam bearing seats in the same relative position as plan elevations for cross-slope, superelevation, and grade. The beams should sit on the same bearing pads or configuration of bearings used in the final location.

The temporary supports must provide a minimum 5-ft (1.5-m) clear distance from the ground surface to the bottom of the beams to allow the SPMTs to move under the spans for lifting.

The caps of the temporary supports must be at least 4.25 ft (1.29 m) wide to accommodate blocking stacks and jacks for lifting. The caps must provide a flat surface to allow all jacks to be at the same elevation.

An as-built field survey should be conducted to verify dimensions and relative elevations.

4.4 Prefabricated Superstructures

Temporary support conditions for the superstructure are to be the same as final support conditions, including dimensions, cross-slope, superelevation, and grade. Allowable elevation tolerance of beam pedestal should be provided.

Longitudinal, horizontal, and vertical dimensions of the superstructure must allow for erection tolerances at the permanent substructures and for transverse deck joint design requirements, for example, a 1-in (2.5-cm) joint at abutments.

Assumed lifting points for the span should be provided.

An as-built field survey should be conducted to verify dimensions and elevations.

Details that address fit-up should be provided, including preformed anchor bolt holes, stainless steel shimming at bearing locations, and, if called for, making the deck continuous over the interior supports after installation.

See “4.9 Possible Design Efficiencies” for options to reduce dead load and improve the efficiency of the move.

4.4.1 Decks

Consideration should be given to scheduling deck casting to ensure proper final deck tolerances to allow adjustments for the as-built condition. A portion of the deck at the ends of the span, for example, 5 ft (1.5 m) from the ends, may be cast in place after the spans are installed. This can facilitate installation, allow flexibility for joint details, and result in improved rideability. Example plan sheet details for a cast-in-place deck closure pour option to facilitate span fit-up are in Appendix B.

An additional sacrificial thickness, for example, 0.5 in (1.2 cm), should be considered in the deck design to accommodate grinding to achieve rideability.

For multibeam spans, the concrete decks must attain design compressive strength before lifting. For truss or arch spans, decks may be constructed after the move to reduce self-weight during the move; bracing must be adequate to prevent excessive distortion.

4.5 Substructures

Cast-in-place substructures must be built within tolerances to allow placement of superstructures with adequate clearance.

4.6 Allowable Temporary Stresses and Deflections

Lifting and moving a bridge with SPMTs usually results in a condition in which the bridge will be temporarily supported at locations that are not the final support points. The designer should check the bridge under these temporary support conditions. Structural members will likely see stress reversals that may be detrimental. An impact factor should be added to the dead load to account for movement on uneven surfaces; a value of at least 15 percent is recommended.

The analysis should also account for the SPMT hydraulic system, which will essentially provide equal bearing at each support. This is especially true for larger bridges where multiple sets of interconnected SPMTs are proposed. The SPMTs will provide soft support for the bridge. Appropriate spring coefficients need to be applied at each support so that the bridge will experience essentially equal reactions. This will result in a redistribution of dead load stresses in the bridge.

The designer should calculate and specify an accurate bridge weight, especially for large bridges. For example, a steel fabricator's estimates are not for the finished product because cutting waste has not been included; the final weight of each piece is not determined until the shop drawings are complete. Simple rule-of-thumb weight estimates for items such as cross frames and diaphragms may not be good enough, and the weight of a coating system alone can be substantial. Accuracy is needed to provide an adequate lifting operation.

The contractor should provide the jacking forces and procedures for lifting a superstructure from its temporary supports to its setting height before installation, and the jacking procedures for lowering a removed superstructure from its setting height to a lower height for demolition.

The contractor should provide analysis of jacking, moving, and erection loads to ensure that temporary stresses and deflections are within allowable values for the bridge and that the bridge is adequately reinforced to handle the calculated temporary stresses without cracking (for example, deck tensile stress). The analysis should include the number of jacking towers at the ends of the span, the jacking force per jack, and the locations of the jacks along the beam length. Jacks at each end are to be connected to each other to push and support equal loads.

The SPMTs will typically lift the bridge spans as near to the final support positions as possible to minimize installation stresses. Lifting points for the move will be controlled by SPMT width and available clearance between obstacles.

Temporary overstresses on the bridge should not be allowed during lifting and moving. Geometric tolerances should avoid excessive stresses while permitting an optimum speed of movement.

The contractor should verify that the bridge is adequately braced during the move (for example, end and intermediate diaphragms of superstructure spans are constructed before transporting).

4.7 Wind Loading

The contractor will provide analysis of wind loads on the bridge at its temporary location and during the move.

The owner should specify a design wind load for movement of bridges. If the owner does not specify the wind speed or load, the owner should be flexible when the contractor chooses a wind speed for the move. Using the AASHTO design load is probably too conservative. The wind speed should be based on statistical analysis that includes the probability of occurrence. Thunderstorms can pop up quickly; just looking at the weather report before a move is not always safe.

An American Society of Civil Engineers (ASCE) document on wind loading during construction is available.[5] This document gives recommendations for reducing the design wind speed based on duration of construction. It should be used for all erection procedures.

4.8 Single-Span Versus Multispan Movements

The advantages of moving multiple-span bridges during one operation include reducing the impact to traffic, eliminating the deck joint(s) at the interior support(s), and improving rideability across the interior supports.

More coordination and close monitoring of stresses and deflections are required for a multispan bridge move to ensure that allowable stresses and deflections are not exceeded (for example, to avoid deck cracking). Greater attention to structural details, ground stability during the move, and equipment synchronization are required. A larger staging area, deeper foundations for the temporary supports, and a wider path from the staging area to the bridge site are also required.

4.9 Possible Design Efficiencies

The convenience and flexibility of constructing bridges offsite, out of traffic, provide several opportunities to further improve design and construction processes. Weight reduction and other design efficiencies can streamline the move.

4.9.1 Reduced Weight for Lifting and Hauling

Consideration should be given to reducing the self weight of these heavier prefabricated systems that must be lifted and hauled into position. Composite dead load design of the superstructure for improved cross-section efficiency with reduced self-weight is possible because shoring can be readily positioned underneath the span in the staging area. Lightweight aggregate can also be used in these systems to reduce self weight.

4.9.1.1 Superstructure Composite Dead Load Design

Since the beams are near the ground and away from traffic on their temporary supports in the staging area, they can easily be shored underneath before deck construction for composite dead load design to

improve cross-section efficiency. Shored construction provides resistance of the deck self-weight by the entire superstructure cross-section and can increase girder efficiency by 30 percent or more, allowing the elimination of a beam or two per span or the use of shallower beams for lower fill heights. These efficiencies will reduce the superstructure dead load for lifting and hauling, potentially requiring fewer SPMT units and reducing ground bearing requirements. Figure 5 shows a composite dead load design concept for beams shored at midspan during deck casting. It should be noted that some States do not allow shored composite construction to accommodate future redecking without supports.

Shoring for composite action is required only until the deck reaches its design strength. The design and construction of the shoring must provide geometry controls to ensure equal load distribution among beams and to avoid differential settlement. Elevation tolerances should be specified. Temporary shoring should be designed using the AASHTO *Guide Design Specifications for Bridge Temporary Works*.

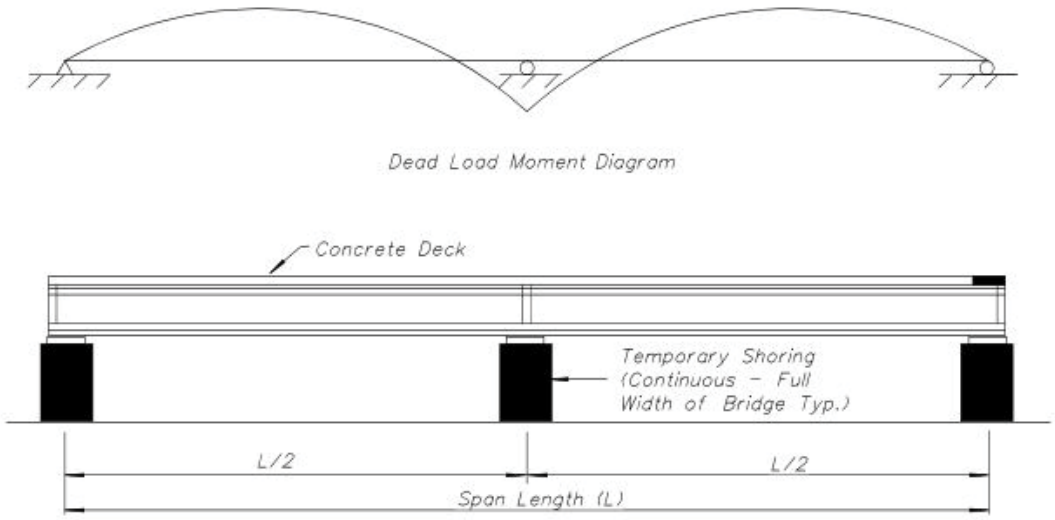


Figure 5. Composite dead load design concept for improved cross-section efficiency. COURTESY OF FDOT

4.9.1.2 Use of Lightweight Aggregate

Another way to reduce the superstructure dead load is by using lightweight concrete. Using lightweight aggregate can reduce the typical 145 to 150 pounds per cubic foot (lb/ft^3) (2,322.6 to 2,402.7 kilograms per cubic meter (kg/m^3)) density of normal-weight concrete to 115 to 120 lb/ft^3 (1,842.1 to 1,922.2 kg/m^3) for structural lightweight concrete. Reducing the concrete density of the entire superstructure (prestressed beams, deck, barriers, etc.) could result in a reduction in dead load of nearly 20 percent that would likely reduce the required number of SPMT units and could also reduce ground compaction requirements.

Cost comparisons should be performed to determine the benefit of the reduced weight on equipment and compaction requirements versus the additional cost of the lightweight concrete. Example calculations for comparing the total bridge weight and estimated cost premium for a bridge with normal-weight concrete and lightweight concrete are in Appendix C.

4.9.2 Bridge Reuse Concepts

Frequently bridges are replaced based on increased highway capacity requirements well before they have reached their useful service life. The ability to lift and drive an entire single- or multiple-span bridge into position with SPMTs expands the potential use of bridges to more than one location. Consideration

could be given in the design of bridge spans to facilitate their relocation in the future to address traffic needs more quickly and at lower cost.

Figure 6 shows a bridge reuse concept in which SPMTs are used to move two existing three-span segmental braided ramps outward onto new supports to facilitate the widening of an Interstate highway.

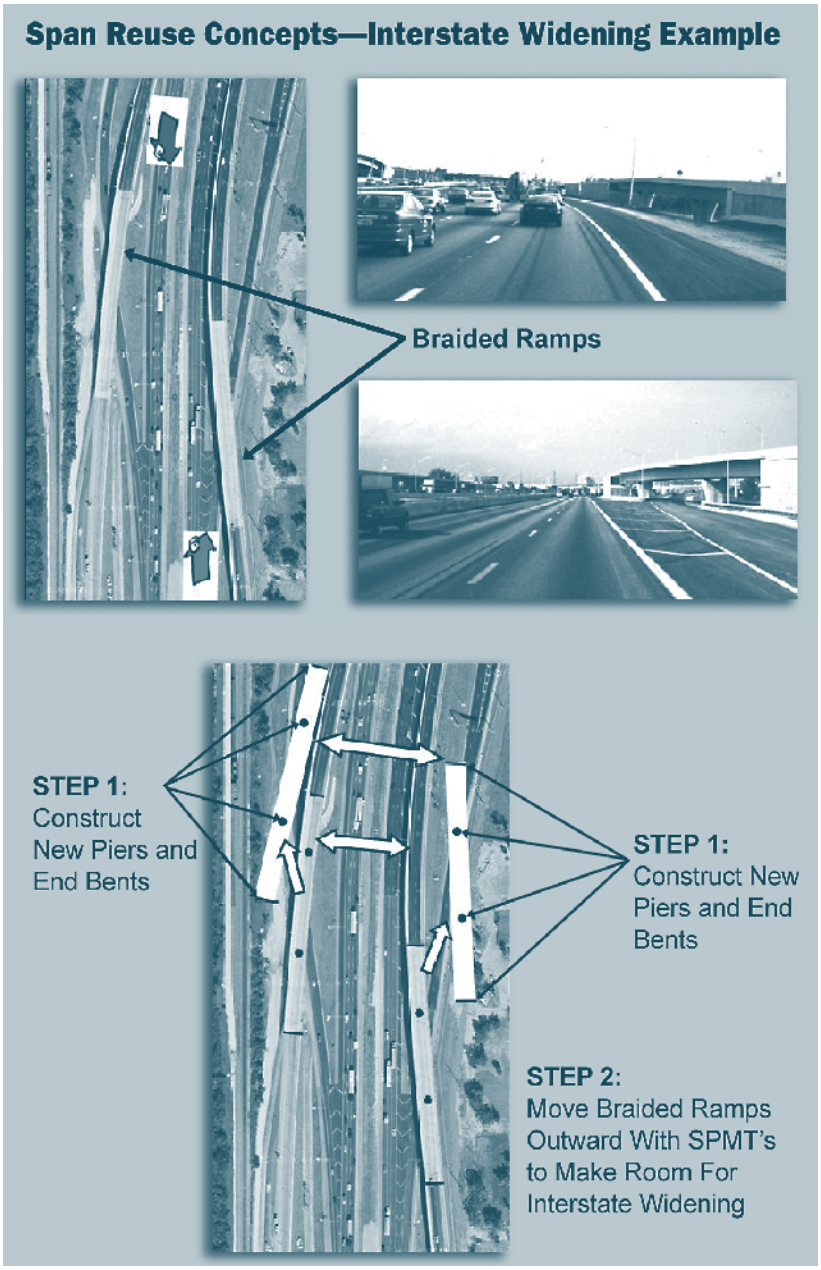


Figure 6. Bridge span reuse concepts—Interstate highway widening example. COURTESY OF FDOT

4.9.3 Other Efficiencies

Additional efficiencies are possible with the use of SPMTs to move bridges. For example, to avoid movement of bearing pads during placement of the beams on their final supports, the bearing pads can be glued or otherwise attached to the beam ends before erection onto their temporary supports at the staging area. The method of attachment must ensure that the pads will not detach during lifting and hauling to the final location.

Chapter 5. Contracting Issues

The use of SPMTs to move bridges may be incorporated into all types of contracts, from typical design-bid-build to design-build to other innovative types of contracts.

SPMT companies typically work as subcontractors to the prime bridge contractor, providing engineering services and operators with their equipment to ensure bridge moves that are within the required specifications for the job.

5.1 Construction Scheme

For accelerated bridge construction projects, the owner should show one feasible construction scheme to move the bridge in the contract documents, and allow contractor-proposed solutions by plan note as long as the solutions meet the traffic control plan closure windows and other project requirements. To change the construction scheme, the contractor must provide signed–and-sealed analyses and details for approval.

Alternatively, the owner could provide both conventional construction details and details for moving the bridge with SPMTs in the contract documents as an option to be used at the contractor's discretion or as an alternate to be bid against the conventional construction details.

A third alternative would be to provide contract documents that show conventional construction, and by plan note allow the contractor to submit a construction method different from conventional construction. This alternative is likely to result in more conventional construction bids since contractors are geared up for conventional construction projects.

5.2 Staging Area

The bridge owner should work with landowners to ensure that at least one staging area that has a feasible path to the final bridge location is available. If the bridge owner knows it will use specific land for staging, it should acquire the land before the bid. Information on the site should be included in the contract documents, with allowance for contractor options to propose and secure alternate locations if it benefits the contractor's operations. The bridge owner should provide raw geotechnical boring information and address existing utility conflicts as required. Unless specified otherwise in the plans, the contractor is responsible for final negotiations with the landowner for using the staging area during the project.

The ground surface should be relatively level at the staging area where the bridge is constructed and along the transport route between the staging area and the bridge's final location. The contractor must ensure that the staging area and the route of the loaded SPMTs have well-compacted soil. Temporary pavement or steel plates under the load may also be used to ensure adequate ground support. Relying solely on steel plates would require a large number of plates or an efficient process of placing the plates in the path of the loaded SPMTs to maintain a reasonable movement speed.

5.3 SPMT Equipment Payment Strategies

The owner should consider including SPMT equipment and related services as a bid item in the contract documents to recognize the large upfront mobilization costs to get the equipment to the project and set up

for use. The owner would need to determine whether to create one or several SPMT bid items (for example, mobilization, move of existing bridge, and move of new bridge).

5.4 Contracting Strategies to Achieve Reduced Timeline

The owner should consider A+B bidding and tie the facility impacts with delay-related user costs in the B component.

The owner should consider bonuses/incentives and penalties/disincentives for early and late completion, respectively, with closure windows clearly defined to achieve accelerated onsite construction timelines. The duration (begin and end date and time of day), day of the week, holidays or exceptions, number of windows allowed, notification requirements, etc., should be included. The owner should set the monetary values high enough to make it worthwhile for the contractors to change their typical operations to achieve the reduced timelines.

The owner should consider lane rental fees for excessive lane closures or late opening of lane closures to encourage the accelerated completion of onsite construction.

The owner should consider allowing value engineering proposals, with the owner and contractor sharing the cost savings.

The owner should consider a prebid conference to ensure that all potential parties understand the project. The SPMT companies should be invited to the conference.

Chapter 6. Contract Documents

Specific plan sheets and specifications that may be included in contract documents for projects that use SPMTs to move bridges are discussed in this chapter. Example plan sheets and specifications are in the appendixes.

In the contract documents, the owner should quantify the penalties for exceeding allowable tolerances or stresses during the moves (for example, geometric tolerances or concrete tensile stresses). The method of measuring the stresses should be based on the system used.

6.1 SPMT Equipment Requirements

Details on SPMT equipment are in the "Description of Equipment" section of Chapter 1. The equipment specification must ensure that the SPMTs will have adequate capability to move the bridge. The four factors that must be considered are stability, spine (frame) strength, hydraulic capacity, and maneuverability. The three factors that determine the required number of SPMT units are stability, spine strength, and hydraulic capacity. When moving bridges, the stability of the SPMTs is not a major concern because multiple units will be used to move a bridge. Therefore, the center of gravity of the bridge is shared among multiple SPMT units, creating a stable system especially when combined with a framing system between the SPMT units at each end of the bridge. As with stability, spine strength is also a minimal concern during transport of a bridge on SPMTs because the travel surface will be relatively level and the load will be evenly distributed across the SPMT platform. The most significant factor in determining the number of SPMT units to use is the hydraulic capacity, which is dictated by the weight and dimensions of the bridge. The fourth factor is maneuverability. SPMTs have the ability to move in any direction for ease of fit-up of the prefabricated bridge systems with the constructed-in-place components.

The contract documents should include an SPMT equipment specification that describes requirements for steering, maximum loads, maximum ground bearing capacity, tolerances for platform flatness, maximum grade that can be traversed, and additional axle-line capacity in case of problems with some of the axles during the move.

Bridge owners who have minimum or no prior experience using SPMTs to move bridges may want to specify in the contract documents that the proposed SPMT operator/subcontractor demonstrate the capacity and capability of its equipment. An owner representative's visit to the operator's yard for a demonstration should verify that the equipment can handle the bridge load within the required tolerances. Failure of the operator to successfully demonstrate the ability of the equipment to adequately perform job requirements would be grounds for canceling a contract.

An example specification for SPMT equipment is in Appendix D.

6.2 Alternative Bridge Installation with SPMTs

The owner should design the project for the SPMT driving installation method to ensure the most efficient and cost-effective use of SPMTs to move bridges.

The plan sheets, however, may be developed for a conventional construction method, with additional wording that allows an alternative bridge installation method. This additional wording in combination with

significant bonuses/incentives and penalties/disincentives for early and late completion, respectively, and/or other contracting strategies can be an alternative means of achieving the owner's reduced construction timeline. Wording for an alternative bridge installation method using SPMTs is on the example contractor alternatives plan sheet in Appendix E.

6.3 Alternative Superstructure Design to Reduce Dead Load

The owner could allow the contractor to propose an alternative superstructure design to obtain a more efficient structure by reducing the effect of dead loads. Possible methods the contractor may use to achieve this include the following:

- Shoring the beams during deck construction for composite action so that the entire cross-section resists the deck self-weight. Wording for an alternative composite dead load bridge design to be used in conjunction with SPMTs is on the example contractor alternatives plan sheet in Appendix E. This sheet can be added to the contract documents to provide guidance to the contractor in selecting options for the project.

- Using lightweight concrete for any or all superstructure elements. The following is an example of wording for the lightweight concrete option that can be added to the contractor alternatives plan sheet in Appendix E:
    - Lightweight concrete may be used for any or all superstructure elements. Lightweight concrete shall conform to the Standard Specifications.

An example specification for lightweight concrete is in Appendix F.

6.4 Contracting Strategies Using Innovative Contracting Methods

The owner should include innovative contracting methods in the contract documents to give the contractor a financial reason to complete the work as specified and within the owner's reduced construction timeline. The contracting methods must be significant enough to make it worthwhile for the contractors to change their typical operations to achieve the reduced timelines. Examples of innovative contracting methods include incentives/disincentives, bonuses, and lane rentals. Another option could be to allow a short-term detour to eliminate a temporary bridge.

6.4.1 Incentive/Disincentive

Incentive/disincentive (I/D) is an alternative contracting technique that uses incentive monies paid to the contractor for early completion of a project or disincentive monies that are subtracted from the contractor for completing the project later than time allowed by the contract. The I/D technique may be a stand-alone method, or may be applied to other alternative contracting techniques, including no-excuse bonus, A+B (cost-plus-time), liquidated savings, lane rental, design-build, or any combination.

I/Ds are assessed daily and can be used to achieve specific project milestones or to encourage timely completion of the total contract. If intermediate milestones are used, it is recommended that a milestone also be placed at the end of the project to ensure overall reduction of contract time.

Project I/Ds are set by the owner based on daily road-user costs and the construction engineering and inspection (CEI) and administration cost expended by the owner. The incentive payments to the

contractor are programmed in the fiscal year in which the incentive payment is expected to be made. Expected payout will occur when the contractor has met the early completion dates noted in the contract.

Two types of I/D contracts are (1) linear, in which the contractor receives or is charged the same daily amount regardless of the number of days completed early or late, and (2) nonlinear (escalating I/D in which the failure-to-work provision applies to the incentive), in which the earlier or later a job is completed, the greater the daily amount paid to or assessed against the contractor.

This concept can be used on a wide variety of project types and is best applied when the owner is willing to pay the contractor to expedite the work to reduce the contract time. It is similar to the A+B (cost-plus-time) concept in that it works well with urban reconstruction and bridge-related projects.

An example incentive/disincentive specification used in conjunction with the contractor alternatives plan sheet in Appendix E is in Appendix G. Examples of other boilerplate incentive/disincentive specifications are in Appendix H.

6.4.2 Bonus

The no-excuse bonus concept is intended to shorten the construction time normally required to perform the work by providing the contractor with a substantial bonus to complete a project within a specified timeframe regardless of any problems or unforeseen condition that might arise. One advantage of this technique is that it motivates efficient construction because it encourages the contractor to keep projects on schedule. Bonuses reward the contractor for early completion, thereby reducing disruption and inconvenience to the traveling public.

Bonuses may be placed on a specific milestone or on a project completion date in the contract specifications for the expressed purpose of completing an element or project within the prescribed time or by a certain date. The bonus can be tied to milestones, a final completion date, or both.

Unforeseen conditions, weather delays, unforeseen site conditions, or other issues that normally extend contract time are not a consideration when granting a bonus. Bonuses are tied to a completion date (timeframe) that is either met or not met. If the bonus date or milestone is not met, the contractor will not receive the bonus. Time extensions are allowed only for catastrophic events, such as a hurricane that directly impacts the contractor's performance.

Utility schedules are crucial when using the no-excuse bonus technique. A contractor may have to accelerate work to get a bonus, requiring the construction engineering and inspection (CEI) parties to also increase staffing or work overtime. The owner may establish contingency funds to cover the increased CEI workload.

Contractors may choose to share bonuses, for example, with utility companies and subcontractors, to get these companies or groups committed to working toward a bonus. Developing and maintaining a realistic schedule is critical for the contractor.

An example bonus specification used in conjunction with the contractor alternatives plan sheet in Appendix E is in Appendix G. Examples of other boilerplate bonus specifications are in Appendix I.

6.4.3 Lane Rental

The lane rental technique is similar to the A+B (cost-plus-time) technique in that the contractors bidding on a lane rental project determine the number of days a lane will be closed during work and use this determination in their bid process. The owner will add the total lane rental bid to the standard bid to decide the award. Awarded contractors using more lane rental days than bid will be charged lane rental fees.

The lane rental fee is based on the estimated cost of delay or inconvenience to the road user during the rental period. The rental fee rates depend on the number and type of lanes closed and can vary for different hours of the day. For example, rush-hour periods from 6:30 to 9 a.m. and 3 to 6 p.m. could have an hourly rental fee of $2,000 for closing one lane, while a lane could be closed at any other time at a rental fee of $500 per hour. The fee is assessed for the time that the contractor occupies or obstructs part of the roadway and is deducted from the monthly progress payments.

The rental fee rates are stated in the bidding proposal and are in dollars per lane per time period. Rental fee rates may be set based on daily, hourly, or fractions-of-an-hour time intervals. The low bid is determined solely on the lowest amount bid for the contract items.

Examples of lane rental specifications are in Appendix J.

6.5 Value Engineering

Value engineering proposals may also be allowed to encourage the contractor to innovate to achieve the reduced construction timelines. Cost savings that result from innovations may be shared by the contractor and the owner. An example value engineering specification is in Appendix K.

6.6 Partnering

The owner should include a formal partnering item in the contract documents to ensure that all parties understand the requirements of the project and to foster relationships that facilitate resolving issues that arise during the project. Discussions should include contingency plans to address potential problems such as insufficient equipment, equipment breakdowns, inclement weather, and inexperienced personnel, as well as logistical issues related to timing of materials, equipment, public notices, and multiple moves within the same window.

An example partnering specification is in Appendix L.

6.7 Traffic Control Plans

Traffic control plans should be consistent with the construction scheme provided in the contract documents. The owner should develop traffic control plans to address detours, rolling roadblocks, crossovers, and closures consistent with traffic control windows defined in the contract.

General notes in the contract documents should accommodate the traffic control requirements for SPMT construction methods. An example list of general notes for traffic control is in Appendix M, with the two modifications for SPMT methods shown in bold.

In many cases one rolling roadblock will be sufficient when using SPMTs to remove or replace a span

crossing a highway. The following process has been used for rolling roadblocks on a two-lane highway when spans of a bridge crossing the highway were removed using SPMTs:

- Rolling roadblocks are allowed during nighttime hours only, for example, midnight to 4 a.m.
- A half dozen or so traffic control officers with law enforcement vehicles equipped with flashing blue lights are required. The actual numbers depend on the length of time required to complete the bridge move and the number of upstream on-ramps along the length of the rolling roadblock.
- A traffic control supervisor is stationed at the bridge site continuously throughout the rolling roadblock operations to provide radio communication among the contractor, the engineer, and the law enforcement vehicles.
- Upon notification by the onsite traffic control supervisor, three law enforcement vehicles enter the highway upstream of the bridge construction site. They enter at the posted speed limit.
- Two of the law enforcement vehicles begin flashing their blue lights and immediately form a side-by-side rolling roadblock of both lanes to slow highway traffic to an operating speed of 20 mi/h (32.1 km/h).
- The third law enforcement vehicle is in front of the side-by-side pacing vehicles to trail the last of the traffic ahead of the rolling roadblock operations. It comes to a complete stop with blue lights flashing 500 ft (152.4 m) from the work zone, blocking both highway lanes until the bridge move is completed.
- Upon notification by the onsite traffic control supervisor, the traffic control officers stationed at each of the upstream entrance ramps to the highway activate their vehicles' flashing blue lights and position their vehicles across the ramps to block access to the highway until the rolling roadblock passes.
- Each rolling roadblock operation cycle creates a 20- to 30-minute time period during which the contractor completes the bridge move.
- The contractor is required to clear equipment and workers from the highway lanes both on the ground and overhead when the pace vehicles are within 1 mi (1.6 km) of the bridge site.
- The contractor is required to wait a minimum of 30 minutes from the end of one rolling roadblock operation to the beginning of the next to permit highway traffic to return to normal speed and to allow the three law enforcement vehicles to return to their designated starting point.

An example traffic control plan sheet for rolling roadblocks used for conventional bridge demolition is in Appendix M (see "I-4 Pacing Operation General Notes"). Only one rolling roadblock is required when SPMTs are used to remove an entire span, compared to conventional demolition in which a rolling roadblock is required for each beam removal.

Depending on the details of the project, it may be necessary to temporarily close a highway when SPMTs are used to install a span crossing the highway, rather than use a rolling roadblock to accomplish the installation. An example traffic control plan for a temporary bridge closure when SPMTs were used to replace spans of a bridge crossing a highway is also in Appendix M (see "I-4 Closure Detail").

6.8 Prefabrication Plan

The contractor must submit a signed-and-sealed prefabrication plan that includes the following:

- Geotechnical engineering assessments of ground stability performance of the staging area and SPMT paths of travel, and any ground improvement plan as necessary; provided by the contractor's geotechnical engineer.
- Design and details for temporary supports, including shallow foundations at the staging area, unless the details are provided in the plan sheets; provided by the contractor's geotechnical and structural engineers.
- Settlement evaluation of temporary supports founded on shallow foundations; provided by the contractor's geotechnical engineer.
- Design and details for prefabricated structures at the staging area, including any shoring for composite dead load design, unless the details are provided in the plan sheets; provided by the contractor's structural engineer.
- Settlement monitoring; provided by the contractor's geotechnical engineer.

6.8.1 Temporary Shoring Bents Founded on Shallow Foundations—Differential Settlement

When temporary shoring bents are founded on shallow foundations, differential settlement between temporary shoring bents (see figure 7) can be a major design consideration. Both span geometry and induced loading are affected by differential settlement in both longitudinal and transverse directions, especially if the beams are continuous. Depending on subsurface condition, the design approach may require deep foundations and/or ground improvement strategies.

An example specification for a report on temporary shoring on shallow foundations settlement is in Appendix N.

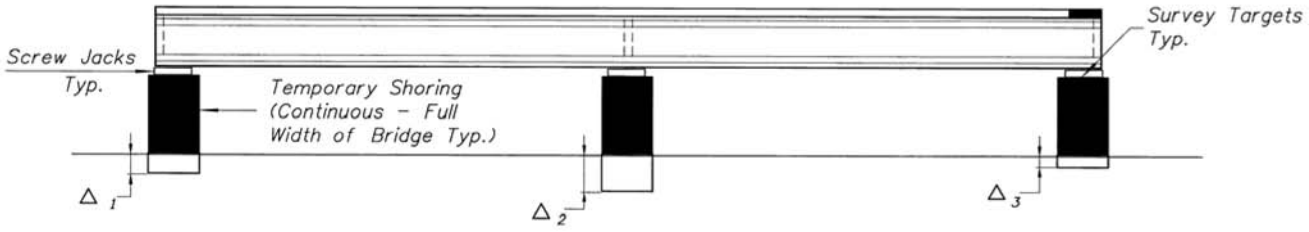


Figure 7. Differential settlement of temporary shoring bents. COURTESY OF FDOT

6.9 Movement Plan, Including Incremental Jacking

To remove an existing span, the SPMTs with lifting equipment are driven under the span, the SPMT platforms are extended to lift the span clear of the piers, and the span is driven to the staging area. Using the SPMT hydraulic system and hydraulic jacks, the span load is transferred to cribbing outside the SPMTs' lifting points on each end of the span.

Once the span is set on cribbing, it can be incrementally lowered using the SPMTs. The SPMTs are driven from underneath the span, the lifting equipment on their platforms is restacked at a lower height, and they are driven back under the span.

The span is lifted by the SPMT hydraulic system, the outside cribbing is lowered, and the span is again transferred from the SPMTs to the cribbing. The process is continued until the span is sitting at the contractor's required height on temporary blocking. The cribbing used for the lowering process is part of the equipment provided by the SPMT company. A similar process in the reverse order is used for lifting, moving, and installing a bridge.

Before moves, the contractor must submit a signed-and-sealed movement plan for approval by the owner that includes the following:

- Erection tolerances and provisions for adjustment; provided by the contractor.
- As-built survey of offsite structures (for example, prefabricated superstructure) and onsite structures (for example, cast-in-place substructure) to verify elevation and dimensional differences consistent with design assumptions for fit-up with adequate tolerances; provided by the contractor.
- Dimensions and weights of structures, including face-to-face distances between obstacles (for example, abutments and piers); provided by the contractor's structural engineer. This information will be given to the SPMT company to determine lift point locations for the moves. Note: For the contractor to provide an adequate lifting operation, the bridge designer should calculate and specify an accurate bridge weight.
- Distance from face of obstacle to lift point for each lift point; provided on the SPMT company's shop drawings. These shop drawings will be given to the contractor's structural engineer for analysis of temporary loading effects.
- Analysis of the effects of the temporary lifting and moving loads on the structures, the maximum geometrical tolerances during the move, and strengthening of the structures as needed to avoid excessive stresses or deflections; provided by the contractor's structural engineer. The assessment of maximum geometric tolerances required during the move should avoid excessive stresses on the bridge while permitting an optimum speed of movement.
- Diagram of the path between the staging area and bridge site, showing direction of motion, dimensions, and clearances; provided by the contractor's engineer. Examples of path and motion diagrams are in Appendix O.
- Geotechnical assessment of ground bearing capacity and defined stability performance requirements along the path between the staging area and the bridge site; provided by the contractor's geotechnical engineer. Include provisions for dealing with ground surfaces that are not sufficiently level or where obstacles are encountered. This would involve placement of fill material, ramps, etc., to enable the bridge to be moved in a way that guarantees its stability and avoids the potential for it to experience unacceptable stresses. A combination of compacted ground, temporary pavement, and steel plates may be used to provide the needed bearing capacity to resist the weight of the loaded SPMTs.

- For water moves, an assessment of barge bearing capacity and defined stability performance requirements along the path between the barge loading area and the bridge site; provided by the contractor's engineer.
- Analysis of wind loads on the bridge at its temporary location and during the move.
- SPMT equipment requirements and signed-and-sealed engineering services, including diagrams and process details for lifting, removing, lowering, and installing operations. Geometric controls during the moves and redundancy in the SPMT power system (for example, a backup system) should also be specified.
- Monitoring of geometric distortion during the move; provided by the contractor's structural engineer.
- Contingency planning for incident management if needed (for example, backup equipment in case of mechanical failure, conventional lifting and demolition equipment onsite for timely clearing of the highway, and a highway detour route for extended closure); provided by the contractor.

The movement plan may be used independently for removal of existing bridges, or in combination with the prefabrication plan for removal of the existing bridge followed by installation of the new bridge.

6.10 Contractor Personnel Plan

The contractor is responsible for providing qualified personnel, including subcontractors, to complete the project. The contractor must submit a personnel plan that defines the following responsibilities:

- Signed-and-sealed design and details for temporary supports and prefabricated structures at the staging area, including any shoring, unless the details are provided in the plan sheets; provided by the contractor's structural engineer.
- Signed-and-sealed geotechnical assessment of ground bearing capacity and defined stability performance requirements at the staging area and along the path between the staging area and the bridge site; provided by the contractor's geotechnical engineer.
- For water moves, a signed-and-sealed assessment of barge bearing capacity and defined stability performance requirements along the path between the barge loading area and the bridge site; provided by the contractor's engineer.
- Prefabrication of the structures.
- Erection tolerances and provisions for adjustment; provided by the contractor.
- Before moves, as-built survey of offsite structures (for example, prefabricated superstructure) and onsite structures (for example, cast-in-place substructure) to ensure fit-up with adequate tolerances; provided by the contractor.
- Dimensions and weights of structures, including face-to-face distances between obstacles; provided by the contractor's engineer.

- Distance from face of obstacle to lift point for each lift point; provided by the SPMT company.

- Diagram of the path between staging area and bridge site showing direction of motion, dimensions, and clearances; provided by the contractor's engineer.

- Signed-and-sealed analysis of the effects of the temporary lifting and moving loads on the structures, the maximum geometric tolerances during the move, and strengthening of the structures as needed to avoid excessive stresses or deflections; provided by the contractor's structural engineer.

- Structure lifting, removing, lowering, and installing diagrams and detailed processes, including geometric controls during the moves; provided by the SPMT company.

- Monitoring of geometric distortion during the move; provided by the contractor's structural engineer.

- Contingency planning for incident management; provided by the contractor.

The contractor will provide SPMT company experience and qualifications.

The contractor must clearly define responsibilities for the various construction processes required to remove and install bridges. For example, a deteriorated superstructure that has been removed from its substructure will arrive at the demolition site at its original elevation. The superstructure loads will then be transferred from the SPMTs to temporary supports for demolition.

The first load transfer will be to temporary supports at about the same height as the original substructures. However, the contractor will likely want to lower the superstructure to be closer to the ground for demolition. The SPMTs can then lower the superstructure in increments until it is as low as 5 ft (1.5 m) off the ground. Similarly, the contractor must delineate whose responsibility it will be to lift the new superstructure to its setting height in the staging area before driving it to its final location.

6.11 Submittal Requirements

The following contractor submittals are required:

- Prefabrication plan
  - Geotechnical assessment at staging area
  - Temporary supports at staging area
  - Settlement report for temporary supports founded on shallow foundations
  - Prefabricated structures at staging area, including temporary shoring for composite dead load design
  - Settlement monitoring

- Movement plan
  - Erection tolerances
  - As-built survey
  - Prefabricated structure dimensions and weights
  - Shop drawings with lift point locations and distances from face of obstacle to lift points
  - Analysis of temporary loads on structures
  - Path and direction of motion

  - Geotechnical assessment for move
  - Barge stability assessment for move
  - Moving equipment and services
  - Distortion monitoring during move
  - Contingency planning for incident management

- Contractor personnel plan, defining personnel for activities outlined in prefabrication and movement plans

Chapter 7. Case Studies

This chapter includes case studies for bridge construction projects using SPMTs for the bridge moves. Extensive details are provided for the Florida Department of Transportation (FDOT) project to replace the Graves Avenue Bridge over I-4. Summary information is provided for the other case studies.

7.1 U.S. Bridge Moves with SPMTs

7.1.1 I-4/Graves Avenue, FDOT

7.1.1.1 Project Description

This FDOT project was the first use of SPMTs to move bridge spans that crossed a U.S. Interstate highway. The existing 215-ft (65.5-m) long Graves Avenue Bridge that crossed I-4 in Volusia County northeast of Orlando in Central Florida was replaced to accommodate the widening of I-4 from four to six lanes. The county bridge's four spans of 37, 70.5, 70.5, and 37 ft (11.2, 21.4, 21.4, and 11.2 m) were replaced with two spans, each 143 ft (43.5 m) long, for a new total bridge length of 286 ft (87 m). Graves Avenue was also widened. The 30-ft (9.1-m) width of the existing bridge was increased to 59 ft (17.9 m) to accommodate two 10-ft (3-m) shoulders and two 5-ft (1.5 m) sidewalks in addition to its two traffic lanes.

The cross section of the bridge was changed from the five and four AASHTO Type III beams in each of the two middle and two end spans, respectively, of the existing bridge to eight 78-in (198.1-cm) deep Florida Bulb-T beams with 8-in (20.3-cm) concrete deck in each of the two spans in the new bridge. The weight of each of the previous 70.5-ft (21.4-m) middle spans was 250 tons (226.7 metric tons); the weight of each new span was 1,300 tons (1,179.3 metric tons). Conventional cast-in-place reinforced concrete substructures with pretensioned concrete driven pile foundations completed the new bridge.

The posted speed on I-4 at Graves Avenue during construction was 70 mi/h (112.6 km/h). No I-4 lane closures were allowed from 6 a.m. to 10 p.m., and lane closures were permitted only during active work periods. In Florida, the removal of existing beams, erection of new beams and stay-in-place forms, and pouring of new bridge deck are not allowed over active traffic; lane closures or rolling roadblocks are required for these activities.

The Graves Avenue at I-4 bridge replacement project was awarded using the A+B bidding method with incentives/disincentives and liquidated damages. It specified conventional construction that required night work and rolling roadblocks. A field change was made to use SPMTs to remove the two middle spans of the existing Graves Avenue Bridge and install the two new longer and wider spans. The bridge required a short closure time because it is near a high school and needed to be open in time for the start of school in the fall. Also, a reduced onsite construction timeline minimized disruption to the 67,800 vehicles (13.5 percent trucks) that use I-4 at this location each day. In addition, a staging area for demolition and prefabrication was available about a quarter mile from the bridge.

Minimal structural design changes were required to use SPMTs to move the new spans, which were conventionally designed. The beams were precast, pretensioned concrete beams fabricated offsite, shipped to the staging area, and erected on the temporary supports that were identical in relative

elevation to the onsite pier configuration. The beams were designed as simple span for both dead load and live load. Intermediate diaphragms were added at midspan, but were not post-tensioned. The full-depth, cast-in-place concrete deck was designed based on strip analysis and did not include post-tensioning. Because of the upward thrust due to beam rotation, additional longitudinal reinforcement was added across the interior support, as typically done in decks in Florida. Expansion joints were located at each span end of this bridge. Placement of the deck concrete was stopped 5 ft (1.5 m) from each side of the interior support to facilitate installation of the spans; the closure pour provided a continuous deck with good rideability. Bridges in Florida are profiled, ground as needed, and transverse-grooved after the entire deck has been placed.

7.1.1.2 Bridge Removal with SPMTs

Before the bridge removals, the contractor removed the two end spans of the existing bridge using conventional means since they were outside the I-4 traffic lanes. SPMTs with 360-ton (326.5-metric ton) capacity were used to remove the two middle spans over I-4. One six-axle SPMT unit was prepositioned in the median under one end of the existing span over I-4 East. On January 9, 2006, the outside lane of I-4 East was closed from 10 p.m. to midnight to position the second six-axle SPMT unit under the other end of the span. At midnight, a 20-minute rolling roadblock began.

A cross-frame connecting the two SPMT units was attached and the span was lifted 6 in (15.2 cm) off its supports. The span was then moved a short distance down I-4 East to the staging area on the right. From lift-off to arrival at the adjacent site took less than half an hour. The process was repeated two nights later for removal of the existing span over I-4 West. Its removal required two rolling roadblocks. A rolling roadblock on I-4 West provided the time required for the SPMTs to lift the span off its supports (see figure 8), drive it slightly west on I-4 West, and then rotate 90 degrees and drive into the median.

At that point a rolling roadblock on I-4 East began. The span was driven onto I-4 East, rotated 90 degrees, and driven down I-4 East to the staging area while I-4 West traffic was opened. Less than an hour was required from the start of the first rolling roadblock until the span arrived at its demolition site. Although not needed, the contractor had contingency plans for unplanned incidents, including backup equipment in case of mechanical failure, conventional lifting and demolition equipment onsite for timely I-4 clearing, a detour route for extended closure of I-4, and a plan to leave existing lane closures in place until the removed span was off I-4 and at the staging area.

7.1.1.3 Bridge Construction and Erection with SPMTs

Concurrent construction of the substructures onsite and the superstructure at the staging area took place from January to June 2006. Substructures were being cast a month after the superstructure deck was cast. The temporary substructures at the staging area were built on above-ground foundations and negligible settlement occurred. The new spans were built 5 ft (1.5 m) off the ground on the temporary supports at the staging area while I-4 was widened and the abutments and interior bent were built onsite. Several days before the scheduled move, the span to go over I-4 West was lifted off its temporary supports by SPMTs, with each end supported by a set of four six-axle SPMT units.

The centroid of the SPMT supports was about 14 ft (4.2 m) from the end of each span to accommodate the width of two side-by-side SPMT units. The span was then jacked in stages to its setting height and supported on sectional barges atop the SPMTs. The contractor had the sectional barges onsite

Figure 8. Removal of FDOT I-4 West Graves Avenue bridge.

for other purposes, and they were used to support the span after being checked to ensure adequate strength. Incrementally lifting the span to setting height took 2.5 days, with monitoring to ensure temporary stresses remained within allowable stresses. On June 3, 2006, both directions of I-4 were closed along a 4-mi (6.4-km) length shortly before midnight, and traffic shifted to a 5-mi (8-km) detour.

In about 30 minutes the SPMTs carried the span along I-4 to the bridge site, straddling both directions of I-4 before moving over to the I-4 West lanes for the installation. As the SPMTs approached the substructure, the operator lifted the platforms to provide clearance over the neoprene bearing pads in position on the substructure bearing seats. Proper alignment of the beams onto the bearing seats took about 2 hours. The process was repeated a week later for installation of the new span over I-4 East. The SPMTs again moved the new span to its final location in about half an hour (see figure 9 on next page), with proper alignment of the beams onto the bearing seats taking about 1.5 hours.

The standard cast-in-place substructure pier cap construction practice in Florida uses the casting of a beam seat pedestal on top of the pier cap; a neoprene pad is then placed on the beam seat pedestal before beam erection. The construction of the pedestals allows final grade adjustments to the beam seats. For the Graves Avenue spans, the beam elevations at the staging area were carefully surveyed to accurately replicate the onsite pedestal elevations. The onsite pedestal elevations were based on the beam seat elevations in the staging area after casting of the deck to account for any settlements to the temporary supports. FDOT has considered allowing stainless steel shims to adjust for any gaps between the beams and the bearing seats, but careful surveying, pedestal placement, and grinding of pedestals as needed have been adequate to date.

The use of the staging area delayed the excavation of the detention pond required at that location. The contractor started excavation immediately after the second installation.

7.1.1.4 Time Savings

The use of prefabricated construction and SPMTs for the Graves Avenue bridge project reduced the construction time from 12 months for conventional construction to 8 months, a reduction of

Figure 9. Installation of FDOT I-4 East Graves Avenue bridge.

one-third due to the concurrent activities of offsite superstructure construction and onsite foundation and substructure construction.

In addition, standard demolition and removal with cranes would have taken about 12 nights of lane closures and multiple rolling roadblocks to remove the existing bridge. A total of 20 additional nights of lane closures would have been required to build a conventional bridge onsite. With five beams to be removed in each of the two existing spans over I-4 and eight beams to be erected in each of the two new spans, a number of rolling roadblock operations would have been required for beam moves alone using conventional methods.

The SPMTs removed the two spans crossing I-4 in two nights with three rolling roadblocks of less than 30 minutes each. At the staging area, in less than 48 hours each span was demolished using conventional methods and rubble was removed. SPMTs moved the two new spans into position in one I-4 nighttime closure of a couple hours each. In summary, the 32 nighttime closures of I-4 required for conventional construction were reduced to four nighttime closures of shorter duration.

7.1.1.5 Initial Construction Costs

The 5.5-mi (8.8 km) I-4 widening project was awarded for $27.6 million in 2004 as a conventional construction project. A supplemental agreement for a change order to incorporate the new technology on the Graves Avenue bridge replacement portion of the existing contract was executed in January 2006 between FDOT and the contractor for an additional $568,175. The change order consisted of (1) removal of the two existing spans over I-4 in one piece each and placing them offsite for demolition, (2) simultaneous construction of the substructure onsite and the superstructure offsite,

and (3) rapid installation of the two new longer and wider spans by lifting and driving them into position. See "6.8 Prefabrication Plan" and "6.9 Movement Plan" for a breakdown of activities.

The breakdown of the $568,175 additional initial construction cost is as follows:
- $132,178 (23 percent) to contractor
- $345,000 (61 percent) to SPMT subcontractor
- $68,497 (12 percent) to bridge subcontractor
- $22,500 (4 percent) to bridge subcontractor's engineering subcontractor

7.1.1.6 Delay-Related User Cost Savings

Prefabrication of the superstructure and its rapid installation using SPMTs limited the closure of Graves Avenue to the traveling public and limited the traffic disruption to I-4 traffic caused by Graves Avenue bridge construction activities. FDOT determined the delay-related user cost benefit to I-4 motorists by using the Arizona Department of Transportation (ADOT) user cost model, as described below. Because of the six traffic lights on the Graves Avenue detour, the analysis of the delay-related user cost benefit to Graves Avenue motorists did not lend itself well to the Arizona model; therefore, user cost savings due to the reduced closure time of Graves Avenue were calculated manually as described below.

Reduced Closure Time of Graves Avenue

To get actual numbers for length and time to travel the original Graves Avenue route (0.6 mi (0.9 km) and 1.0 minute) and the detour route (2.05 mi (3.2 km) and 5.5 minutes), the routes were driven and measured on a weekday midmorning. Subtracting the original distance and time from the detour distance and time gave 1.45 mi (2.3 km) and 4.5 minutes. The delay-related user cost per vehicle was 1.45 miles x $0.50/mile plus 4.5 minutes/60 minutes x $10.45/hr average user wage = $0.725 + $0.784 = $1.51 per vehicle. The vehicle count on Graves Avenue was 12,010 vehicles per day. Therefore, the cost per day was 12,010 vpd x $1.51/vehicle = $18,135.10 per day of detour. (Note: The $0.50/mile cost is based on cars, trucks, and school buses.)

The delay-related user cost savings for the reduction of 4 months of detour time was $18,135.10/day x 4 months x 30 days/month = $2,176,212. This number is conservative because the times for the six traffic lights on the detour could be longer than at midmorning when the measurements were taken.

Reduced Traffic Disruption on I-4

Conventional construction would have required 32 nights of lane closures for construction operations that include removal of the two old bridge spans (12 nights) and construction of the new bridge spans by erecting the beams, erecting the deck forms and overhang forms, and casting the new deck (20 additional nights). The new technology required only four nights total: two nights to remove the old spans and two nights to set the new spans. The user cost savings per day was determined using the ADOT user cost model spreadsheet, as shown in table 2 (see next page). The additional user cost savings was 28 nights x $1,774.38 per night = $49,683. (Note: The "Average User Wage" used in the ADOT user cost model spreadsheet for the I-4/Graves Avenue project was updated for subsequent projects, as shown in Appendix A[4], per the latest figures from the U.S. Bureau of Labor Statistics.)

7.1.1.7 Net Cost Savings From Use of New Technology

The Graves Avenue detour was reduced from 12 to 8 months for a time savings of 4 months and a

COMPUTATION OF DAILY VALUE

Project: I-4 and Graves Avenue bridge
FPN: 242417-1-52-01
County: Volusia

PROJECT DATA	Unit	Condition 1	Condition 2	Condition 3	Condition 4	Condition 5	Confition 6
(work program est.) as 12/10/04							
STATE ESTIMATED DURATION=	Days	600					
STATE $ ESTIMATE=	$	$27,591,340					
ADT=	Veh	67,800					
TRUCKS=	%	13.5%					
AVG USER WAGE=	$/Hr.	$11.58					
TOTAL # OF LANES OPEN (CONSTR)=	ea.	1					
DURATION OF T.C. CONDITION=	Days	28					
SPEED LIMIT (CONSTR)=	mph	70					
LENGTH (CONSTR)=	Miles	1.000					
TOTAL # OF LANES OPEN (NEW)=	ea.	2					
SPEED LIMIT (NEW)=	mph	70					
LENGTH (NEW)=	Miles	1					
CONSIDER OTHER IMPACTS (YES/NO)=		NO					
ONE DIRECTIONAL TRAFFIC (YES/NO)=		NO					
MAXIMUM DAILY VALUE=		$9,197.11					
ADD'L TIME TO TRAVEL THRU=	Hrs.	0.05					
DAILY VALUE=		$1,774.38					
SUM=		$1,774.38					
TOTAL DAILY VALUE ALLOWED=		$1,774.38					
Liquidated Damages=		$10,673.66					

MODEL BASE OF ARIZONA DEPARTMENT OF TRANSPORTATION COST MODEL

COURTESY OF FDOT

Table 2. ADOT user cost model spreadsheet for disruption to I-4 motorists.

delay-related user cost savings of $2,176,212. Lane closures on I-4 were reduced from 32 nights to four nights, for a time savings of 28 nights and a user cost savings of $49,683. Total savings to the traveling public was $2.226 million.

The net benefit was $2.226 million delay-related user cost savings minus $0.568 million initial construction cost, or $1.658 million net delay-related user cost savings. The $568,175 initial construction cost was the net value after reduction for offsetting savings due to the new technology, such as cost savings of traffic control from reduced closures. No time for finishing earlier was given back to FDOT because the bridge was not on the critical path for the overall I-4 widening project. Staged replacement of the bridge using conventional construction would not have been possible without buying right-of-way since the centerline of the existing narrow two-lane bridge without shoulders was the centerline of the new wider two-lane bridge with shoulders and sidewalks.

7.1.1.8 Participants

FDOT administered the project. Volusia County owns the bridge. Metric Engineering, Inc., of Miami, FL, designed the replacement bridge. Ranger Construction Industries, Inc., of West Palm Beach, FL, was the prime contractor. Leware Construction Company of Leesburg, FL, was the bridge subcontractor, and IDA Consulting Engineers, Inc., of Orlando, FL, was Leware's engineering firm. Mammoet was the SPMT subcontractor.

7.1.1.9 Post-Installation Interviews with Contractor and Bridge Subcontractor

Both the contractor and the bridge subcontractor were pleased with the use of SPMTs to move bridges on the project. Comments received include the following:

- Time and money were saved by removing the existing spans and demolishing them at the staging area.
- A fiber optics line kept pile driving for the substructure foundations in limbo for about 6 weeks, but there was no delay because the superstructure was being constructed concurrently at the staging area.
- Saved 4 months but could have saved more time if there had been an incentive.
- Impressed with the speed.
- Allow enough flexibility for installations so that 0.5-in (1.27-cm) variation in placement does not matter; for example, make bearing pads and cap widths wider.
- Day work at staging area is preferable to onsite construction. With uninterrupted and nonrestrictive work hours for superstructure construction at the staging area, no day was missed after beam erection.
- High degree of quality control is required both at staging area and at final location.
- Would have been better if offsite construction had been written into the contract.
- Would prefer that contract specify maximum number of days that work can impact traffic.
- Pull bridge projects such as this one out from I-4 widening and let separately.
- Prefers complete closures to partial lane closures.

7.1.1.10 Lessons Learned

Lessons learned from the FDOT Graves Avenue bridge over I-4 project are as follows:

- Contractually require the road work to keep pace with the accelerated delivery of the bridge.
- Consider allowing a midspan-supported beam assembly at the staging area for composite dead

load design of the prefabricated superstructure to improve cross-section efficiency. Include as an option in the contract documents. This may save a line of beams but would require additional temporary shoring.

- The successful completion of the project made it clear that the use of qualified SPMT companies and the latest equipment and performance specifications were essential to achieving the short onsite construction times and good long-term performance of the new bridge.

- Clearly define who is responsible for providing dimensions and weights of the structures to be moved, including face-to-face distances between obstacles. Based on this information, the SPMT company will develop shop drawings that show lift point locations with distance from face of obstacle to lift point for each lift point.

- Design wider substructure caps and wider clearances to facilitate installation.

- Consider round bearing pads and avoid skewed bearing pads.

- Consider permanently attaching the bearing pads to the bottom of the beams in the plant to avoid setting problems on the substructure.

- The owner should clearly specify the dates and time limits for bridge closure windows in the contract documents, providing adequate bonuses/incentives for early completion and penalties/disincentives for late completion, and including lane rentals and other contracting strategies to achieve the reduced construction timeline.

- The contractor should clearly delineate which construction processes are to be completed by the SPMT company. For example, the contractor should clearly specify that the SPMT subcontractor is to lower a removed span to 5 ft (1.5 m) above the ground at the staging area to facilitate its demolition. The incremental process required to lower the span requires time and additional equipment that the SPMT subcontractor may have to ship to the site.

- The ground at the staging area and along the SPMT path should not be freshly placed, but instead should be compacted early as needed to allow adequate time for settlement.

- Substructures should be built within construction tolerances to ensure proper fit-up with prefabricated superstructures (for example, backwalls should be plumb).

- Set steel plates close to abutment face to provide adequate ground capacity for SPMTs during span-setting operation.

- In span-setting operations, the SPMTs should move closer to the median until in position transversely, if space allows, and then move perpendicularly to set the beams on the abutment bearing seats. Adjustment is needed to accommodate the angle of motion due to the SPMT hinged elbow that moves down during setting operations. To avoid that angle of motion, the contractor should consider using synchronized vertical jacks mounted on the SPMT platform's top cribbing instead of the SPMT hydraulic system to lower the span to set it.

- Spans should be driven into position high during setting operations to accommodate the roadway crown.

- Consider use of laser guidance to line up superstructure with the abutment backwall.

7.1.2 I-10/LA 35, LaDOTD

This Louisiana Department of Transportation and Development (LaDOTD) project was the first use of SPMTs to replace damaged Interstate bridge spans at an intersection. In January 2006 LaDOTD replaced two 60-ft (18.2-m) AASHTO Type III pretensioned concrete beam spans on I-10 after an overheight load traveling under I-10 hit and damaged both the I-10 East and I-10 West bridges over SR 35 at Rayne, near Lafayette. After the September 2005 accident, SR 35 was partially closed and the I-10 bridges were shored while spans identical to the damaged ones were fabricated adjacent to the site. Use of SPMTs to remove the damaged spans and install the new spans was chosen to minimize the closure time of both I-10 and SR 35.

On January 24, 2006, the I-10 East bridge was closed and traffic detoured onto an off-ramp before the bridge and an on-ramp onto I-10 after the bridge. Two sets of six-axle SPMT units were waiting to lift the existing I-10 East span, and another two sets of six-axle SPMT units were loaded with the new I-10 East span. The temporary shoring was removed from under the existing span. The two SPMT units then moved under the bridge, lifted the damaged span, moved it away from the bridge, and rotated it before crossing the median to a nearby demolition site.

As soon as the existing bridge was out of the way, the new span was moved into position. The entire process from moving in the SPMTs to remove the damaged span to final setting of the new span took about half an hour. The process was repeated two nights later to remove the damaged I-10 West span and install the new I-10 West span. For each night, the maximum time of I-10 traffic detour was 10 hours, and the detour time could have been further reduced by doing more of the preparatory work before the closure. See figure 10.

Figure 10. Installation of LaDOTD I-10/LA35 bridge.

The emergency replacement cost $1.0 million, including the two new spans, equipment, subcontractors, labor, and Louisiana State Police services. The SPMT subcontractor cost was about 13 percent of the total cost.

7.1.3 Providence River Bridge, RIDOT

The Rhode Island Department of Transportation (RIDOT) Providence River bridge replacement project is part of the reconstruction of I-195 in Providence. The main span is a steel network arch, defined as an arch with inclined cables that cross more than once. The span has three arches to support its 400-ft (121.9-m) length and 160-ft (48.7-m) width that will provide eight traffic lanes. It was assembled at a staging area near the location of barges that moved it up the Providence River for erection.

Mammoet's SPMTs in combination with its strand jack lifting system, shown in figure 2(d), were used to lift the span and move it onto the barges. The contractor requested a field change to use SPMTs to allow erection of the bridge on land and subsequent transfer onto the barges using the SPMTs. In the past, other bridges have been built on barges and transferred to construction sites, but rental cost of the barges is high. The SPMTs allowed a short-term rental of the barges, saving the contractor significant money. In addition, using the SPMTs on barges facilitated final placement of the bridge near a hurricane-barrier site constraint that prevented the use of cranes to erect the span. See figure 11.

Figure 11. SPMTs move RIDOT Providence River bridge span onto barges at staging area.

7.1.4 Wells Street Rapid Transit Bridge, City of Chicago

The Wells Street Bridge was an 1899 steel rapid transit bridge crossing Wacker Drive in Chicago, IL. In 2002, the 111-ft (33.8-m) long, 425-ton (385.5-metric ton) prefabricated steel replacement truss span was built near the site as a result of a value-engineering proposal initiated by the contractor, and rolled into place with SPMTs to connect to shorter spans on each end. See figure 12.

The use of SPMTs made it possible for the bridge to be replaced over a weekend. The short

Figure 12. Wells Street bridge installation in Chicago.

closure was needed to minimize disruption in the schedule of the Chicago Transit Authority (CTA) elevated trains. The project was completed on time, avoiding a delay penalty to the contractor of $1,000 per minute. Disruption was significantly shortened for both vehicle and transit users. Conventional construction would have required rebuilding the bridge in sections over several weekends, and the CTA would have had to provide additional shuttle services.

7.1.5 Lewis and Clark Highway Bridge Deck Replacement, WSDOT

The Lewis and Clark Bridge is on SR 433 crossing the Columbia River between Oregon and Washington. A full-depth, precast concrete deck replacement was completed in 2004 for this 5,500-ft (1,676.4-m) long historic 1929 steel truss bridge. The majority of the existing bridge deck, 3,900 ft (1,188.7 m), was replaced with 103 full-depth, full-width, prefabricated, precast, lightweight concrete deck panels supported by longitudinal steel beams with intermediate transverse beams. SPMTs with a specially designed lifting and transporting frame moved a new panel to the top of the bridge, lifted the old panel that was just cut out, lowered the new panel into place, and moved the old panel off the bridge (see figure 13 on next page). The 36-ft (10.9-m) wide panels ranged from 20 to 45 ft (6 to 13.7 m) long, with a maximum panel weight of 96 tons (87 metric tons). One panel was replaced per night within a 6-hour period.

Time constraints allowed full closures from 9:30 p.m. until 5:30 a.m. Monday through Thursday. The deck replacement was completed in only 124 nights plus three weekend closures. Conventional deck replacement would have required replacing the deck lane by lane over a 4-year period, closure for several months, or closure every weekend for 6 months. Use of SPMTs allowed the bridge to remain open for normal weekday operation.

Figure 13. WSDOT Lewis and Clark bridge deck replacement.

7. 2 European Bridge Moves with SPMTs

7.2.1 A4/A5 Highway Bridge near Amsterdam's Schipol Airport, Badhoevedorp, Netherlands

This two-span, horizontally curved, post-tensioned concrete bridge is 390 ft (118.8 m) long and weighs more than 3,600 tons (3,265.8 metric tons). The bridge is part of a newly constructed highway that crosses the A4/A5 expressway, one of the Netherlands' busiest highways near Amsterdam's Schipol Airport.

A total of 134 axle lines of SPMTs were coupled together to move the bridge from its nearby temporary supports to its final location. Specifications allowed a maximum deflection of 4 in (10.1 cm) in the bridge from midpoint to end, about 180 ft (54.8 m). Deflections were controlled during the move using a theodolite. A third-party measuring crew continuously monitored a dozen points installed on the bridge and reported them to the owner for calculation of stresses. The project required good ground preparation and level surfaces.

The move took 2 hours. The expressway was closed for only one weekend compared to almost a year that would have been required for conventional construction. See figures 14(a) and 14(b).

Figure 14(a). SPMTs lift two-span bridge crossing Amsterdam's A4/A5 expressway off temporary supports. COURTESY OF MAMMOET

Figure 14(b). SPMTs move bridge crossing Amsterdam's A4/A5 expressway to final location. COURTESY OF MAMMOET

7.2.2 PRA 1309 Railway Bridge, France

The 2004 Prefabricated Bridge Elements and Systems Scan team visited the site of the four-span PRA 1309 Railroad Bridge, which crosses a new highway at Nonant Le Pin in France. The bridge was constructed on a concrete slab adjacent to its final location, as shown in the foreground of figure 15.

Figure 15. SPMTs moved four-span PRA 1309 railway bridge in France.

SPMTs moved the bridge, complete with substructure, a distance of 146 ft (44.5 m) to its final location. The average travel speed was 8 in (20.3 cm) per minute. The SPMTs lifted the temporary concrete beams that were cast between the supports to move the bridge. After the bridge was installed, the

temporary beams were cut into sections to reduce their hauling size and weight. The protruding end sections shown in the photo were also removed.

The SPMTs moved the bridge into position in 8 hours. The rail line was closed for only 48 hours.

Chapter 8. Conclusions and Recommendations

SPMTs are computer-controlled platform vehicles that can move bridge systems weighing up to several thousand tons with precision to within a fraction of an inch. The prefabrication of bridges offsite under controlled conditions followed by rapid installation onsite can achieve quality installations with traffic impacts of minutes to a few hours compared to the months typically required for conventional onsite bridge construction. This technology should be considered for all bridge replacement projects where reduced onsite construction time is a priority, for example, in locations with high traffic volume.

The manual provides details from project conception to completion for using SPMTs to remove or install a bridge. Also included are various example calculations, diagrams, plan sheets, and specifications to use as a starting point for projects using SPMTs to remove or install bridges. The use of this manual in combination with the FHWA decisionmaking framework and analysis of delay-related user costs should provide the guidance that bridge owners and other bridge professionals need to understand the technology, determine whether using SPMTs will benefit a specific bridge project, and develop contract documents that incorporate the technology.

References

1. *Prefabricated Bridge Elements and Systems in Japan and Europe,* FHWA-PL-05-003, Federal Highway Administration, Washington, DC, January 2005.

2. Ralls, M.L., B.M. Tang, and H.G. Russell, "Self-Propelled Modular Transporters for Bridge Movements in Europe and the U.S.," Proceedings, Transportation Research Board 6th International Bridge Engineering Conference, July 2005.

3. "Framework for Prefabricated Bridge Elements and Systems (PBES) Decision-Making," FHWA-IF-06-30, Federal Highway Administration, Office of Bridge Technology, Washington, DC, January 2005, http://www.fhwa.dot.gov/bridge/prefab/framework.cfm.

4. Florida DOT's modification of Arizona DOT cost model, http://www.dot.state.fl.us/construction/DistrictOffices/d5webnew/word%20excel%20files/ADOT%20User%20Cost%20Model.xls.

5. *Design Loads on Structures During Construction,* SEI/ASCE 37-02, American Society of Civil Engineers, Reston, VA, 2002.

Example User Cost Model Spreadsheet

FDOT I-4 and SR 530 (US 192) Interchange Project

COMPUTATION OF DAILY VALUE

Project: I-4 & SR 530 (US 192) Interchange
FPN: 242531-1-52-01
County: Osceola

PROJECT DATA	Unit	Condition 1	Condition 2	Condition 3	Condition 4	Condition 5	Confition 6
STATE ESTIMATED DURATION=	Days	870					
STATE $ ESTIMATE=	$	$66,300,000					
ADT=	Veh	95,000					
TRUCKS=	%	11.5%					
AVG USER WAGE=	$/Hr.	$17.09					
TOTAL # OF LANES OPEN (CONSTR)=	ea.	4					
DURATION OF T.C. CONDITION=	Days	800					
SPEED LIMIT (CONSTR)=	mph	70					
LENGTH (CONSTR)=	Miles	1.386					
TOTAL # OF LANES OPEN (NEW)=	ea.	6					
SPEED LIMIT (NEW)=	mph	70					
LENGTH (NEW)=	Miles	1.386					
CONSIDER OTHER IMPACTS (YES/NO)=		NO					
ONE DIRECTIONAL TRAFFIC (YES/NO)=		NO					
MAXIMUM DAILY VALUE=		$15,241.38					
ADD'L TIME TO TRAVEL THRU=	Hrs.	0.02					
DAILY VALUE=		$23,406.44					
SUM=		$23,406.44					
TOTAL DAILY VALUE ALLOWED=		$15,241.38					

MODEL BASE OF ARIZONA DEPARTMENT OF TRANSPORTATION COST MODEL

Liquidated Damages= $21,125.00

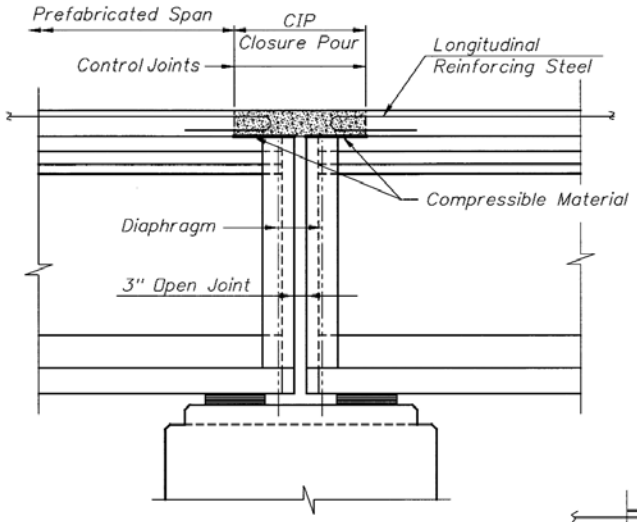
SPREADSHEET COURTESY OF FDOT

Appendix B

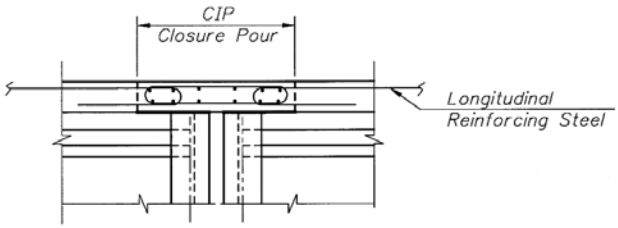
Example Plan Sheet Details for Cast-in-Place Deck Closure Pour Option to Facilitate Span Fit-up

Cast-in-Place Deck Closure Pour Option

Moving in whole spans with SPMTs requires consideration for span fit-up. Expansion joints may be eliminated by making the bridge deck continuous over the support. Details that reduce the width of closure pour and that facilitate span fit-up are desirable. See sketch below showing a cast-in-place closure pour option.



Section B–B
Reinforcing Steel Not Shown for Clarity.



Closure Pour Reinforcing Steel

Appendix C

Example Calculations for Comparing Total Bridge Weight and Estimated Cost Premium for Normal-Weight Concrete and Lightweight Concrete Bridge

FDOT Graves Avenue/I-4 Project

Total Weight and Cost for Normalweight and Lightweight Concrete Bridges

Bridge Information

Girder Type	FL Mod BT-78	
No. of Girders	8	
Length of Girders	143.00	ft
Total Deck Width	59.00	ft
Deck Thickness	8.00	in.
Haunch Thickness	3.00	in.

Bold & shaded entries are input values

Compute Weight of Bridge

		Normalweight Concrete		Lightweight Concrete		
Girders						
	Total Length	1,144.00	ft	1,144.00	ft	
	Density	152	pcf	127	pcf	*83.6%*
	Total Weight	1,334,349	lbs	1,114,884	lbs	
	Total Volume	325	cy	325	cy	
Deck						
	Total Volume	5,624.67	cf	5,624.67	cf	
	Density	150	pcf	120	pcf	*80.0%*
	Total Weight	843,700	lbs	674,960	lbs	
	Total Volume	208	cy	208	cy	
Haunch						
	Total Volume	1,430.00	cf	1,430.00	cf	
	Density	150	pcf	120	pcf	
	Total Weight	214,500	lbs	171,600	lbs	
	Total Volume	53	cy	53	cy	
Barriers						
	Total Wt / ft	1,200	plf	960	plf	
	Density	150	pcf	120	pcf	
	Total Weight	171,600	lbs	137,280	lbs	
	Total Volume	42	cy	42	cy	
Total		2,564,149	lbs	2,098,724	lbs	
		1,282	***tons***	***1,049***	***tons***	***81.8%***
	Weight Reduction			***233***	***tons***	***18.2%***

Compute Cost Premium for Lightweight Concrete Bridge

			Assumed Cost Premiums for LWC			
Girders	325	cy	@	$ 30.00	/ cy =	$ 9,750
Deck, Barriers, etc.	303	cy	@	$ 25.00	/ cy =	$ 7,575
Total	***628***	***cy***				***$ 17,325***
Cost Premium / sf of Deck Area				***$ 2.05***	***/ sf***	

Notes:

LWC Deck mix is assumed to be 4.5 ksi with plastic (fresh) density of 115 pcf and an allowance of 5 pcf for reinforcement.

LWC Girder mix is assumed to be 8 ksi with plastic (fresh) density of 120 pcf and an allowance of 7 pcf for reinforcement.

Both LWC mixes are sand-lightweight mixes, i.e., normalweight sand and lightweight coarse aggregate.

Both NWC mixes are assumed to have a plastic (fresh) density of 145 pcf and an allowance of 5 pcf for reinforcement in the deck and 7 pcf in the girder.

Plastic (fresh) densities, rather than equilibrium densities, are used here for the LWC because of the short time between concrete placement and installation of bridge.

Cost premiums for LWC mixes will vary depending on several factors, including the distance to the LW aggregate source and cost of normalweight aggregates.

SPREADSHEET COURTESY OF STALITE

Appendix D

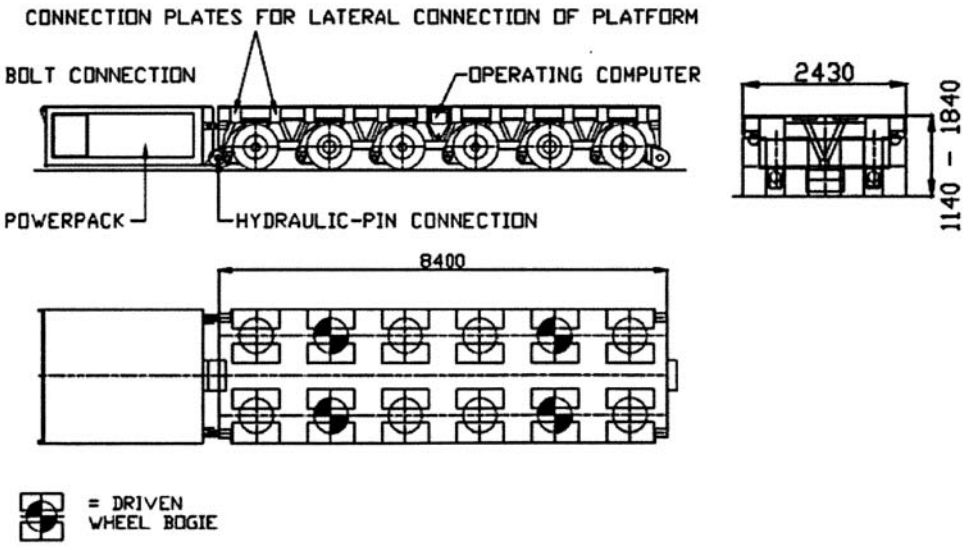
Example Specification for SPMT Equipment

Self-Propelled Modular Transporter (SPMT) Equipment Specification

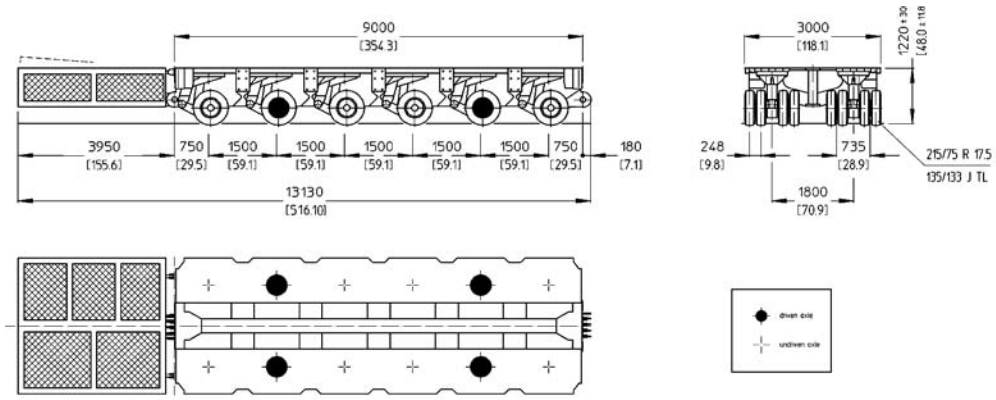
Self-propelled modular transporters (SPMTs) are used for rapid removal and installation of bridge systems. An operator, using a computer controller connected by cables to the SPMT powerpack units, drives the SPMTs under the bridge and lifts the bridge from its supports using the SPMT hydraulic suspension system without the need of cranes or other auxiliary lifting equipment. The operator then walks with the SPMTs as the bridge is driven to its final location for exact positioning as required.

The SPMTs shall consist of four-axle units or six-axle units, with powerpacks. Each unit shall be either 8 feet (ft) (2.4 meters (m)) wide with four wheels per axle or 10 ft (3 m) wide with eight wheels per axle; the axle spacing shall not exceed 5 ft (1.5 m). The SPMT system shall be modular in nature and capable of connecting to each other both laterally and longitudinally to create the platform width and length needed to support the load; the required number of SPMT modular units is based on total weight and stability of the system. The SPMT units shall be computer linked to act together as one unit to ensure safe transport of the bridge. The SPMTs shall have a detachable powerpack module unit with a water-cooled turbo-diesel engine that activates the hydraulic pumps for drive, steering, axle compensation, and stroke. An 8-ft (2.4-m) wide six-axle unit and a 10-ft (3-m) wide six-axle unit are shown below.

The 8-ft (2.4-m) wide six-axle SPMT unit:



The 10-ft (3-m) wide six-axle SPMT unit:



The top surface of the unloaded SPMT platform at its lowest position shall be no higher than 4 ft (1.2 m) from the ground surface. Factors such as magnitude of load, tire compression, platform camber, and ground surface variation along the travel path affect the loaded SPMT platform travel height. The preferred minimum platform travel height is 44–60 inches (in) (111.7–152.4 centimeters (cm)), but the platform height may be as low as 36–50 in (91.4–127 cm) during travel.

The minimum available vertical stroke of the SPMT platform shall be approximately 24 in (60.9 cm), and the vertical lift range shall be approximately 36–60 in (91.4–152.4 cm). An available vertical stroke of 16–20 in (40.6–50.8 cm) should be assumed for operational purposes.

Each axle line shall have a minimum load capacity of 25–30 tons (23-27 metric tons), depending on unit width. The SPMT units shall be assembled in length and width to accommodate the required bridge size and weight for lifting, transporting, and setting. The SPMTs shall include lifting equipment to equally support all the beams at each span end.

The SPMTs shall be capable of traveling with the bridge load on uneven terrain having surface variations up to 18 in (45.7 cm), at up to 8 percent grade depending on ground surface friction, and with a maximum 1,500–2,000 pounds per square foot (7,323.6–9,764.8 kilogram-force per square meter) ground pressure (approximated as the load divided by the area of the platform). The loaded SPMTs shall be capable of traveling at a minimum 3 miles per hour (4.8 kilometers per hour).

The hydraulic axle compensation shall guarantee equal loads on all wheel sets, independent of the road conditions. Series-mounted safety valves shall ensure that upon a hose rupture on the wheel set, the pressure is maintained in the remaining undamaged hydraulic circuit, thus preventing one side of the platform from tilting by redistributing the load to the remaining wheel sets.

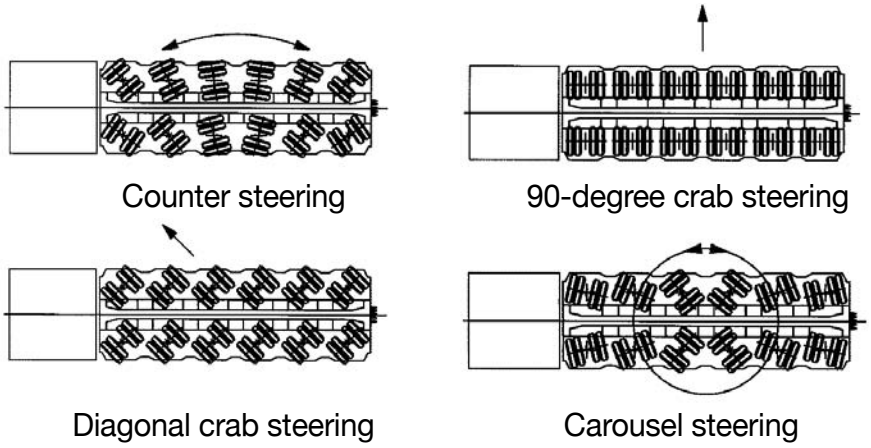
In no case shall the platform be out-of-level by more than 6 degrees during lifting, transporting, setting the bridge, or during equipment malfunction. In addition, the configuration of the SPMT must consider the location of the bridge center of gravity relative to the stability of the combined load such that out-of-level limits are established to safely avoid overturning.

The SPMTs shall have either a three-point or a four-point suspension to transport the bridge load safely. The appropriate suspension depends on the project requirements. The center of gravity must be located within the stability triangle or box to provide a safe move.

Out-of-service situations such as flats and/or failures shall be anticipated and contingencies planned accordingly to ensure that the operators can manually coordinate the units if required to complete the bridge move. The SPMT equipment shall have additional capacity to allow 5 percent of the axles to be out-of-service.

The frame (spine) and loading platform shall be welded steel construction with main longitudinal beams. The spine strength shall be adequate for the bridge load as required by the SPMT manufacturer.

The SPMT shall have all-electronic steering capability to pivot 360 degrees about its support point, allowing for normal steering, diagonal steering, crab steering, circular steering, carousel steering, and counter steering as shown below.



Counter steering

90-degree crab steering

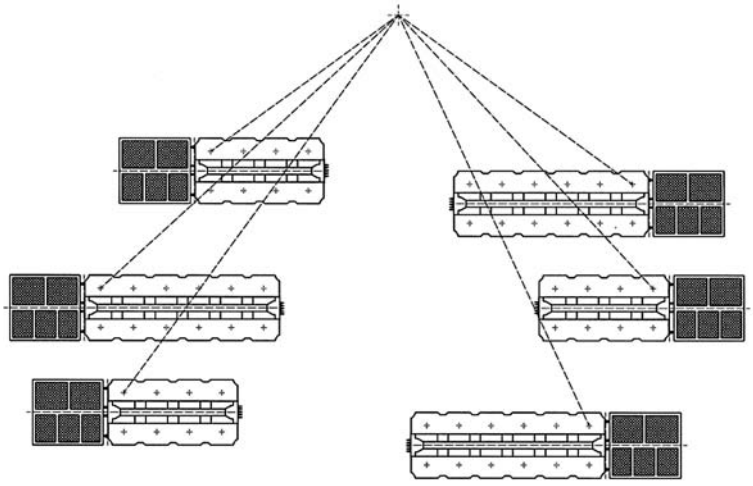
Diagonal crab steering

Carousel steering

Each wheel set shall be controlled simultaneously by the controller. The central computer shall control all wheel sets to work independently, but together to provide for transport of large bridge loads by a series of independent, computer-linked SPMTs as shown below.

Steering of Trailers

PST-E: Centre point for steering

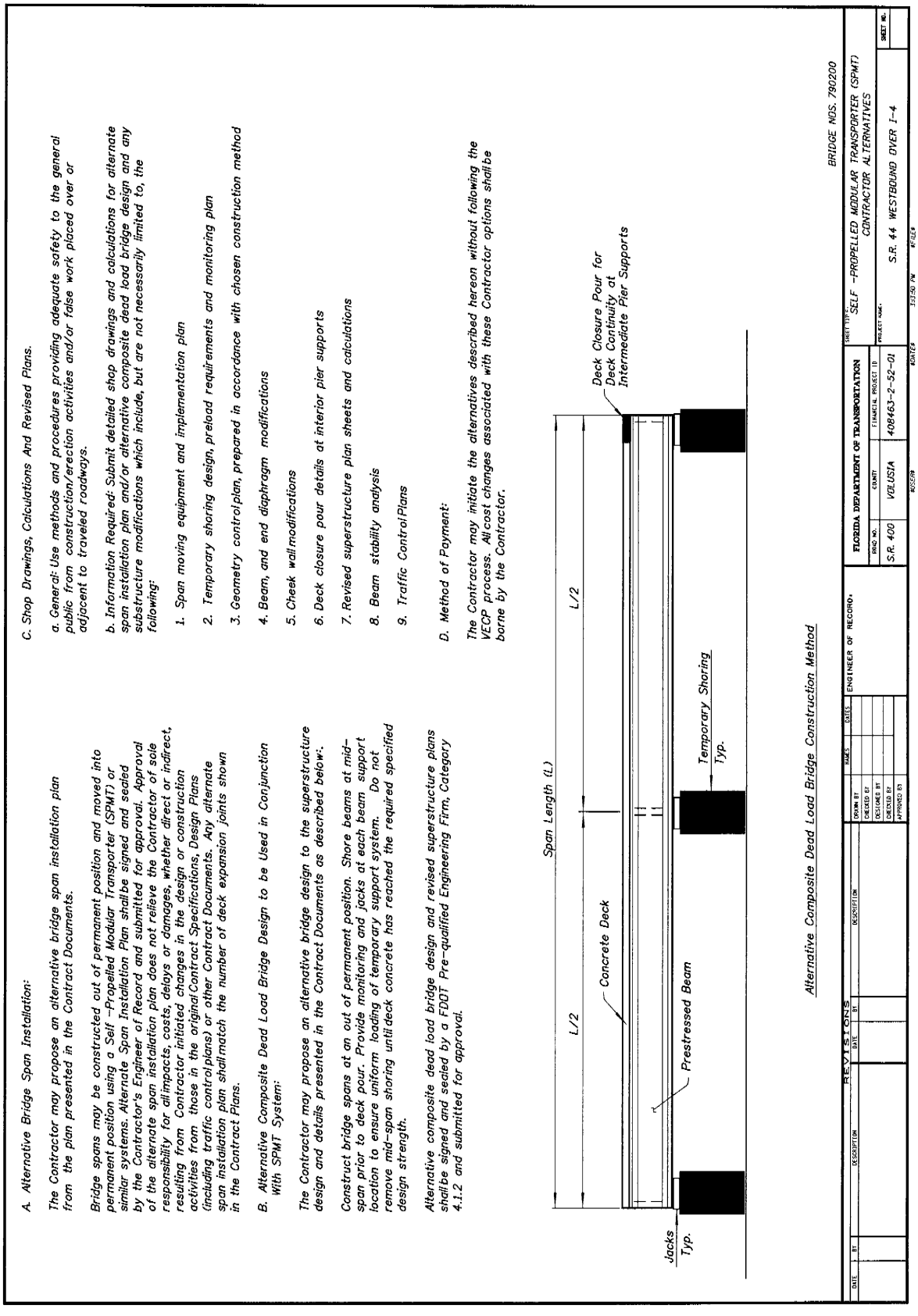


The SPMT operator/contractor shall have previous experience with the use of SPMTs to move bridges or comparable loads, and shall demonstrate the ability of its equipment to adequately perform job requirements.

Appendix E

Example Plan Sheet for Contractor Alternatives

FDOT SR 44 W/I-4 Project



A. Alternative Bridge Span Installation:

The Contractor may propose an alternative bridge span installation plan from the plan presented in the Contract Documents.

Bridge spans may be constructed out of permanent position and moved into permanent position using a Self -Propelled Modular Transporter (SPMT) or similar systems. Alternate Span Installation Plan shall be signed and sealed by the Contractor's Engineer of Record and submitted for approval. Approval of the alternate span installation plan does not relieve the Contractor of sole responsibility for all impacts, costs, delays or damages, whether direct or indirect, resulting from Contractor initiated changes in the design or construction activities from those in the original Contract Specifications, Design Plans (including traffic control plans) or other Contract Documents. Any alternate span installation plan shall match the number of deck expansion joints shown in the Contract Plans.

B. Alternative Composite Dead Load Bridge Design to be Used in Conjunction With SPMT System:

The Contractor may propose an alternative bridge design to the superstructure design and details presented in the Contract Documents as described below:.

Construct bridge spans at an out of permanent position. Shore beams at mid-span prior to deck pour. Provide monitoring and jacks at each beam support location to ensure uniform loading of temporary support system. Do not remove mid-span shoring until deck concrete has reached the required specified design strength.

Alternative composite dead load bridge design and revised superstructure plans shall be signed and sealed by a FDOT Pre-qualified Engineering Firm, Category 4.1.2 and submitted for approval.

C. Shop Drawings, Calculations And Revised Plans.

a. General: Use methods and procedures providing adequate safety to the general public from construction/erection activities and/or false work placed over or adjacent to traveled roadways.

b. Information Required: Submit detailed shop drawings and calculations for alternate span installation plan and/or alternative composite dead load bridge design and any substructure modifications which include, but are not necessarily limited to, the following:

1. Span moving equipment and implementation plan
2. Temporary shoring design, preload requirements and monitoring plan
3. Geometry control plan, prepared in accordance with chosen construction method
4. Beam, and end diaphragm modifications
5. Cheek wall modifications
6. Deck closure pour details at interior pier supports
7. Revised superstructure plan sheets and calculations
8. Beam stability analysis
9. Traffic Control Plans

D. Method of Payment:

The Contractor may initiate the alternatives described hereon without following the VECP process. All cost changes associated with these Contractor options shall be borne by the Contractor.

Span Length (L)

L/2

L/2

Concrete Deck

Deck Closure Pour for Deck Continuity at Intermediate Pier Supports

Prestressed Beam

Temporary Shoring Typ.

Jacks Typ.

Alternative Composite Dead Load Bridge Construction Method

REVISIONS

DATE	BY	DESCRIPTION

DATE	BY	DESCRIPTION

DRAWN BY / DATE
CHECKED BY
DESIGNED BY
CHECKED BY
APPROVED BY

ENGINEER OF RECORD

FLORIDA DEPARTMENT OF TRANSPORTATION

RWD NO.	COUNTY	FINANCIAL PROJECT ID
S.R. 400	VOLUSIA	408463-2-52-01

SHEET TITLE: SELF -PROPELLED MODULAR TRANSPORTER (SPMT) CONTRACTOR ALTERNATIVES

PROJECT NAME: S.R. 44 WESTBOUND OVER I-4

SHEET NO.

BRIDGE NOS. 790200

Appendix F

Example Specification for Lightweight Aggregate

FDOT Standard Specifications

901-4 Lightweight Aggregates.

901-4.1 Lightweight Coarse Aggregate for Bituminous Construction: Lightweight coarse aggregate may be produced from naturally occurring materials such as pumice, scoria and tuff or from expanded clay, shale or slate fired in a rotary kiln. It shall be reasonably uniform in quality and density, and free of deleterious substances as specified in 901-1.2, except that the term cinders and clinkers shall apply to those particles clearly foreign to the extended aggregate in question.

In addition, it must meet the following specific requirements:

Material passing the No. 200 Sieve ..... maximum 3.00%, (FM 1-T 011)
Dry loose weight (AASHTO T 19)..... 33-55 lb/ft^{3*}
Los Angeles Abrasion (FM 1-T 096) ..... maximum 35%
Ferric Oxide (ASTM C 641) ..... maximum 1.5 mg
*Source shall maintain dry-loose unit weight within $\pm$6% of Quality Control average.
Point of use dry-loose unit weight shall be within $\pm$10% of Source Quality Control average.

901-4.2 Lightweight Coarse Aggregate for Structural Concrete: The requirements of 901-4.1 are modified as follows:

Aggregates shall not be produced from pumice and scoria.
Los Angeles Abrasion (FM 1-T 096, Section 12) shall be 45%, maximum.
Gradation shall meet the requirements of AASHTO M 195 for 3/4 inch, 1/2 inch and 3/8 inch.

Appendix G

Example Specification for Incentive/Disincentive and Bonus Used in Conjunction with Contractor Alternatives Plan Sheet (Appendix E)

FDOT SR 44 W/I-4 Project

PROSECUTION AND PROGRESS.
(REV 7-28-97) (7-01)

SECTION 8 (Pages 71-86) is expanded by the following new Article:
ARTICLE 8-13. Alternative Bidding. The following new Subarticles are added:

8-13.1 Incentive - Disincentive for A+B.
(REV 7-27-04) (FA 7-28-04) (1-05)

The Department desires to expedite construction on this Contract to minimize the inconvenience to the traveling public and to reduce the time of construction. In order to achieve this, an incentive—disincentive provision is established for the Contract. The total incentive payment or disincentive deduction shall not exceed **$2,350,000.00**.

In the event the Contractor completes the Contract prior to the expiration of the Original Contract Time, the Department will pay the Contractor an incentive payment in the Daily Value amount specified in provision 3-1 for each calendar day the actual completion date precedes the Original Contract Time and subject to the conditions precedent set forth below. The term "Original Contract Time" as used in this Article will mean the number of calendar days established for completion of the work in the Contract on the date the Contract was executed. The term "calendar day" as used in this Article will mean every day shown on the calendar. Calendar days will be consecutively counted from commencement of Contract Time regardless of weather, weekends, holidays, suspensions of Contractor's operations, delays or other events as described herein. For purposes of the calculation and the determination of entitlement to the "incentive payment" stated above, the Original Contract Time will not be adjusted for any reason, cause or circumstance whatsoever, regardless of fault, save and except in the instance of a catastrophic event (i.e., hurricane or a declared state of emergency).

The parties anticipate that delays may be caused by or arise from any number of events during the course of the Contract, including, but not limited to, work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers, subcontractors or other contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of Contractor's operations, or other such events, forces or factors sometimes experienced in highway construction work. Such delays or events and their potential impacts on performance by the Contractor are specifically contemplated and acknowledged by the parties in entering into this Contract, and shall not extend the Original Contract Time for purposes of calculation of the "incentive payment" set forth above. Further, any

SPECIAL PROVISIONS FPID(S): 408463-1-52-01, etc.

and all costs or impacts whatsoever incurred by the Contractor in accelerating the Contractor's work to overcome or absorb such delays or events in an effort to complete the Contract prior to expiration of the Original Contract Time, regardless of whether the Contractor successfully does so or not, shall be the sole responsibility of the Contractor in every instance.

In the event of a catastrophic event (i.e., hurricane or a declared state of emergency) directly and substantially affecting the Contractor's operations on the Contract, the Contractor and the Department shall agree as to the number of calendar days to extend the Original Contract Time so that such extended Original Contract Time will be used in calculation of the "incentive payment." In the event the Contractor and Department are unable to agree to the number of calendar days to extend the Original Contract Time, the Department shall unilaterally determine the number of calendar days to extend the Original Contract Time reasonably necessary and due solely to such catastrophic event and the Contractor shall have no right whatsoever to contest such determination, save and except that the Contractor establishes that the number of calendar days determined by the Department was arbitrary or without any reasonable basis.

However, notwithstanding anything above to the contrary, upon the Contractor's written request being made directly to the Chief Engineer, with copies provided to both the Resident Construction Engineer and the District Construction Engineer, the Department reserves unto the Chief Engineer, in his sole and absolute discretion, according to the parameters set forth below, the authority to make a determination to either fully enforce the above provisions with no modification, modify the "Original Contract Time" by moving it, or both modify the "Original Contract Time" by moving it and also modify the "incentive payment" amount by reducing it.

No modification of this "Incentive-Disincentive" provision will be considered by the Chief Engineer for any impacts, whatsoever, beyond the reasonable control of the Contractor, the effect of which results in a time extension of less that 15% of the time remaining in the period from first day of occurrence of such impact to the "Original Contract Time." Furthermore, as to any such impact, the effect of which results in a time extension of 15% or more of the time remaining in the period from first day of occurrence of such impact to the "Original Contract Time." No modification of this "Incentive-Disincentive" provision will be considered by the Chief Engineer unless the Contractor clearly establishes that it has continuously from the beginning of the project aggressively, efficiently and effectively pursued the achievement of the "incentive payment," including the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work so as to still achieve the "incentive payment," and that, but for this impact, the Contractor would have otherwise earned the "incentive payment" provided in the original Contract. Also, to the extent the request is not submitted in writing to the Chief Engineer within not less than twenty (20) calendar days prior to the original "Original Contract Time," the Contractor must also continue to aggressively, efficiently and effectively pursue the completion of the "Incentive-Disincentive" work, including the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work, until a determination is made by the Chief Engineer or twenty (20) calendar days has expired since such written request was received by the Chief Engineer. There shall be no right of any kind on behalf of the Contractor to challenge or otherwise seek review or appeal in any forum of any determination made by the Chief Engineer under this provision.

The Contractor shall have no rights under the Contract to make any claim arising out of this "incentive payment" provision except as is expressly set forth in this Article.

As conditions precedent to the Contractor's entitlement to any "incentive payment" the Contractor must: (1) Deliver in-hand to the Department any and all claims, in full accordance with 5-12.3 and subject to the limitations therein, no later than 60 calendar days after completion of the work on which such claim is based and tentatively schedule a Disputes Review Board hearing while awaiting Department review and response to any such claim. Furthermore, as to any such 5-12.3 claims for which the Disputes Review Board has determined entitlement but both parties have not reached an agreement on monetary compensation prior to final acceptance, and also as to those 5-12.3 claims pending at final acceptance, tentatively schedule a Disputes Review Board hearing within 60 calendar days of the final acceptance while awaiting Department review and response to any such claim; and the sole forum for final determination as to both entitlement and amount of monetary compensation, if not otherwise mutually resolved or otherwise agreed, shall be the Disputes Review Board.

(2) Actually complete the Contract and obtain final acceptance by the Department prior to expiration of the Original Contract Time.

(3) No later than 60 days after final acceptance by the Department, the Contractor must either (a) elect to be paid the "incentive payment" pursuant to (4) below or (b) notify the Department in writing that the Contractor is electing to be paid the "incentive payment" and is reserving one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board. The determinations of the Disputes Review Board as to any such 5-12.3 claims will be fully binding on both the Department and the Contractor, with no right of any kind of challenge, review or appeal in any forum by either party. Further, under (b) herein, any previous Disputes Review Board determinations on any such 5-12.3 claims issues shall then be fully binding and not subject to reconsideration by the Disputes Review Board, regardless of whether either party has previously rejected or otherwise not accepted one or more such recommendations at the time such were rendered.

(4) The Contractor shall notify the Department in writing, within 60 days after final acceptance of the Contract by the Department, that the Contractor elects to be paid the "incentive payment" which the Contractor is eligible to be paid based on the actual final acceptance date, and such written notice shall constitute a full and complete waiver, release and acknowledgment of satisfaction by the Contractor of any and all claims, causes of action, issues, demands, disputes, matters or controversies, of any nature or kind whatsoever, known or unknown, against the Department, its employees, officers, agents, representatives, consultants, and their respective employees, officers and representatives, the Contractor has or may have, including, but not limited to, work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers or subcontractors or other contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of Contractor's operations, extended or unabsorbed home office or job site overhead, lump sum maintenance of traffic adjustments, lost profits, prime mark-up on subcontractor work, acceleration costs, any and all direct and indirect costs, any other adverse impacts, events, conditions, circumstances or potential damages, on or pertaining to, or as to or arising out of the Contract. This waiver, release and acknowledgment of satisfaction shall be all inclusive and absolute, save and except any routine Department final estimating quantity adjustments.

SPECIAL PROVISIONS FPID(S): 408463-1-52-01, etc.

Should the Contractor fail to actually complete the Contract and obtain final acceptance by the Department prior to expiration of the Original Contract Time, or should the Contractor, having timely completed the Contract and obtained final acceptance by the Department prior to expiration of the Original Contract Time but having failed to timely request the "incentive payment" for any reason, and including but not limited to the Contractor choosing not to fully waive, release and acknowledge satisfaction as set forth in (4) above, the Contractor shall have no right to any payment whatsoever under this Article. Notwithstanding the Contractor's election or non-election of the incentive under this provision, the disincentive provision applies to all circumstances where the work in the Contract is not finally accepted by the Allowable Contract Time.

Completion and acceptance of the Contract for purposes of this Article shall be in accordance with 5-11.

Should the Contractor fail to complete the Contract on or before expiration of the Allowable Contract Time, as adjusted in accordance with the provisions of 8-7.3, the Department shall deduct from the monies due the Contractor the Daily Value as shown in provision 3-1 for each calendar day completion exceeds the Allowable Contract Time. The term "Allowable Contract Time" as used in this Article shall mean the Original Contract Time plus adjustments pursuant to 8-7.3. This deduction shall be the disincentive for the Contractor's failing to timely complete the Contract. Article 8-10 relating to liquidated damages remains in effect and is applicable.

In the event the Contractor elects to exercise this "incentive payment" provision, should this provision conflict with any other provision of the Contract, the Contract shall be interpreted in accordance with this provision.

8-13.2 "Bonus" Payment and Waiver of Contractor Claims.
(REV 12-15-03) (FA 1-8-04) (7-04)

The Department desires to expedite construction on this Contract to minimize the inconvenience to the traveling public and to reduce the time of construction. In order to achieve this, "Bonus" provisions are established for the Contract Work Items described below.

The Department will pay the Contractor a "Bonus" as follows:

Contract Work Item	Bonus Completion Date	Bonus Amount
Complete and open to traffic both directions of Cassadaga Road over 1-4.	August 1, 2007	$200,000

The "Bonus" will be paid only if the "Contract Work Item" is completed as set forth above, and as determined by the Engineer, on or before the "Bonus Completion Date" as set forth above, and subject to the conditions precedent set forth below. For purposes of the calculation and the determination of entitlement to the "Bonus" stated above, the "Bonus Completion Date" will not be adjusted for any reason, cause or circumstance whatsoever, regardless of fault, save and except in the instance of a catastrophic event (i.e., hurricane or a declared state of emergency).

The parties anticipate that delays may be caused by or arise from any number of events during the course of the Contract, including, but not limited to, work performed, work deleted, change orders, supplemental

agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers, subcontractors or other contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of Contractor's operations, or other such events, forces or factors sometimes experienced in highway construction work. Such delays or events and their potential impacts on performance by the Contractor are specifically contemplated and acknowledged by the parties in entering into this Contract, and shall not extend the "Bonus Completion Date" set forth above. Further, any and all costs or impacts whatsoever incurred by the Contractor in accelerating the Contractor's work to overcome or absorb such delays or events in an effort to complete the Contract by the "Bonus Completion Date," regardless of whether the Contractor successfully does so or not, shall be the sole responsibility of the Contractor in every instance.

In the event of a catastrophic event (i.e., hurricane or a declared state of emergency) directly and substantially affecting the Contractor's operations on the Contract, the Contractor and the Department shall agree as to the number of calendar days to extend the "Bonus Completion Date." In the event the Contractor and Department are unable to agree to the number of calendar days to extend the "Bonus Completion Date," the Department shall unilaterally determine the number of calendar days to extend the "Bonus Completion Date" reasonably necessary and due solely to such catastrophic event and the Contractor shall have no right whatsoever to contest such determination, save and except that the Contractor establishes that the number of calendar days determined by the Department was arbitrary or without any reasonable basis.

However, notwithstanding anything above to the contrary, upon the Contractor's written request being made directly to the Chief Engineer, with copies provided to both the Resident Construction Engineer and the District Construction Engineer, the Department reserves unto the Chief Engineer, in his sole and absolute discretion, according to the parameters set forth below, the authority to make a determination to either fully enforce the above provisions with no modification, modify the "Bonus Completion Date" by moving it, or both modifying the "Bonus Completion Date" by moving it and also modify the "Bonus" amount by reducing it.

No modification of a "Bonus" provision will be considered by the Chief Engineer for any impacts whatsoever, beyond the reasonable control of the Contractor, for which the effect results in a time extension of less that 15% of the time remaining in the period from the first day of occurrence of such impact to the "Bonus Completion Date," Furthermore, as to any such impact, for which the effect results in a time extension of 15% or more of the time remaining in the period from the first day of occurrence of such impact to the "Bonus Completion Date," no modification of a "Bonus" provision will be considered by the Chief Engineer unless the contractor clearly establishes that it has continuously from the beginning of the project aggressively, efficiently and effectively pursued the achievement of the "Bonus." This would include the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work so as to still achieve the "Bonus," and, but for this impact, the Contractor would have otherwise earned the "Bonus" provided in the original Contract. Also, to the extent the request is not submitted in writing to the Chief Engineer within not less than twenty (20) calendar days prior to the original "Bonus Completion Date," the Contractor must also continue to aggressively, efficiently, and effectively pursue the completion of the "Bonus" work. This would include the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work, until a determination is

made by the Chief Engineer or twenty (20) calendar days has expired since such written notice. There shall be no right of any kind on behalf of the Contractor to challenge or otherwise seek review or appeal, in any forum, of any determination made by the Chief Engineer under this provision.

The Contractor shall have no rights under the Contract to make any claim arising out of this "Bonus" provision except as is expressly set forth in this Article.

As conditions precedent to the Contractor's entitlement to any "Bonus" the Contractor must:
(1) Deliver in-hand to the Department any and all claims in full accordance with 5-12.3 and subject to the limitations therein, no later than 60 calendar days after completion of the work on which such claim is based and tentatively schedule a Disputes Review Board hearing while awaiting Department review and response to any such claim. Furthermore, as to any such 5-12.3 claims for which the Disputes Review Board has determined entitlement but both parties have not reached an agreement on monetary compensation prior to final acceptance, and also as to those 5-12.3 claims pending at or submitted after "Bonus Date," tentatively schedule a Disputes Review Board hearing within 60 calendar days after the final acceptance date while awaiting Department review and response to any such claim. The sole forum for final determination as to both entitlement and amount of monetary compensation, if not otherwise mutually resolved, or otherwise agreed, shall be the Disputes Review Board.

(2) Actually complete the "Contract Work Item" and obtain written verification of completion from the Engineer on or before the "Bonus Completion Date."

(3) No later than 60 days after "Bonus Date" by the Department, the Contractor must either (a) elect to be paid the "Bonus" pursuant to (4) below, or (b) notify the Department in writing that the Contractor is electing to be paid the "Bonus" and is reserving one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board. The determinations of the Disputes Review Board as to any such 5-12.3 claims will be fully binding on both the Department and the Contractor, with no right of any kind of challenge, review or appeal, in any forum, by either party. Further, under (b) herein, any previous Disputes Review Board determinations on any such 5-12.3 claims issues shall then be fully binding and not subject to reconsideration by the Disputes Review Board, regardless of whether either party has previously rejected or otherwise not accepted one or more such recommendations at the time such were rendered.

(4) The Contractor shall notify the Department in writing, within 60 days of receiving written verification of completion of the "Contract Work Item" by the Engineer per (2) above, that the Contractor elects to be paid the "Bonus" which the Contractor is eligible to be paid based on the actual "Bonus Completion Date," and such written notice shall constitute a full and complete waiver, release and acknowledgment of satisfaction by the Contractor of any and all claims, causes of action, issues, demands, disputes, matters or controversies, of any nature or kind whatsoever, known or unknown, against the Department, its employees, officers, agents, representatives, consultants, and their respective employees, officers and representatives, the Contractor has or may have as to work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers or subcontractors or other contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of the Contractor's operations, extended or unabsorbed home office or job site overhead,

lump sum maintenance of traffic adjustments, lost profits, prime mark-up on subcontractor work, acceleration costs, any and all direct and indirect costs, any other adverse impacts, events, conditions, circumstances or potential damages, on or pertaining to, or as to or arising out of the Contract. This waiver, release and acknowledgment of satisfaction shall be all-inclusive and absolute, save and except any routine Department final estimating quantity adjustments.

Should the Contractor fail to actually complete the "Contract Work Item" and obtain written verification of completion of the "Contract Work Item" from the Engineer on or before the "Bonus Completion Date," or should the Contractor, having done so, fail to timely request the "Bonus" for any reason, and including but not limited to the Contractor choosing not to either reserve one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board as set forth in (3)(b) above, or to fully waive, release and acknowledge satisfaction as set forth in (4) above, the Contractor shall have no right to any payment whatsoever under this Article.

In the event the Contractor elects to exercise the "Bonus Payment" provision, should this provision conflict with any other provision of the Contract, the Contract shall be interpreted in accordance with this provision.

As to any Contract Work Item provided for herein, the Contractor will remain responsible for all such work and the continued maintenance thereof until such date as the Department final accepts all Work under the Contract in accordance with 5-11, and without regard to whether the Department has provided written verification of completion or not, and without regard to whether any "Bonus" was earned or elected hereunder.

8-13.3 Incentive-Disincentive.
(REV 12-15-03) (FA 1-8-04) (7-04)

The Department desires to expedite construction on this Contract to minimize the inconvenience to the traveling public and to reduce the time of construction. In order to achieve this, incentive-disincentive provisions are established for the Contract Work Items described below. The total combined incentive payment(s) or disincentive deduction(s) shall not exceed **$2,350,000.00.**

Contract Work Item	Incentive-Disincentive Completion Date	Incentive-Disincentive Daily Amount	Incentive-Disincentive Total Amount
Contract Work Item 408463-1-52-01 Complete and open to traffic both directions of Cassadaga Road over 1-4.	August 1, 2007	$7,500 per day	$150,000 max.
Complete project in accordance with 5-11	Original Contract Time (Contractor Time Bid (B))	$15,500 per day	$2,000,000 max.

The Department will pay the Contractor an "incentive payment" in the amount of the "Incentive-Disincentive Daily Amount" as set forth above for each calendar day the actual completion date of the "Contract Work Item" as set forth above precedes the "Incentive-Disincentive Completion Date" as

set forth above, and as determined by the Engineer and subject to the conditions precedent set forth below. For purposes of the calculation and the determination of entitlement to the "incentive payment" stated above, the "Incentive-Disincentive Completion Date" will not be adjusted for any reason, cause or circumstance whatsoever, regardless of fault, save and except in the instance of a catastrophic event (i.e., hurricane or a declared state of emergency).

The parties anticipate that delays may be caused by or arise from any number of events during the course of the Contract, including, but not limited to, work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers, subcontractors or other contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of Contractor's operations, or other such events, forces or factors sometimes experienced in highway construction work. Such delays or events and their potential impacts on performance by the Contractor are specifically contemplated and acknowledged by the parties in entering into this Contract, and shall not extend the "Incentive-Disincentive Completion Date" for the purposes of calculation "incentive payment" as set forth above. Further, any and all costs or impacts whatsoever incurred by the Contractor in accelerating the Contractor's work to overcome or absorb such delays or events in an effort to complete the Contract by the "Incentive-Disincentive Completion Date," regardless of whether the Contractor successfully does so or not, shall be the sole responsibility of the Contractor in every instance.

In the event of a catastrophic event (i.e., hurricane or a declared state of emergency) directly and substantially affecting the Contractor's operations on the Contract, the Contractor and the Department shall agree as to the number of calendar days to extend the "Incentive-Disincentive Completion Date" so that such extended "Incentive-Disincentive Completion Date" will be used in calculation of the "incentive payment." In the event the Contractor and Department are unable to agree to the number of calendar days to extend the "Incentive-Disincentive Completion Date," the Department will unilaterally determine the number of calendar days to extend the "Incentive-Disincentive Completion Date" reasonably necessary and due solely to such catastrophic event and the Contractor shall have no right whatsoever to contest such determination, save and except that the Contractor establishes that the number of calendar days determined by the Department was arbitrary or without any reasonable basis.

However, notwithstanding anything above to the contrary, upon the Contractor's written request being made directly to the Chief Engineer, with copies provided to both the Resident Construction Engineer and the District Construction Engineer, the Department reserves unto the Chief Engineer, in his sole and absolute discretion, according to the parameters set forth below, the authority to make a determination to either fully enforce the above provisions with no modification, modify the "Incentive-Disincentive Completion Date" by moving it, or both modify the "Incentive-Disincentive Completion Date" by moving it and also modify the "incentive payment" amount by reducing it.

No modification of an "Incentive-Disincentive" provision will be considered by the Chief Engineer for any impacts whatsoever, beyond the reasonable control of the Contractor, for which the effect results in a time extension of less than 15% of the time remaining in the period from the first day of occurrence of such impact to the "Incentive-Disincentive Completion Date." Furthermore, as to any such impact, for

which the effect results in a Time Extension of 15% or more of the time remaining in the period from the first day of occurrence of such impact to the "Incentive-Disincentive Completion Date," no modification of an "Incentive-Disincentive" provision will be considered by the Chief Engineer unless the Contractor clearly establishes that it has continuously from the beginning of the project aggressively, efficiently and effectively pursued the achievement of the "incentive payment." This would include the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work so as to still achieve the "incentive payment," and that, but for this impact, the contractor would have otherwise earned the "incentive payment" provided in the original Contract. Also, to the extent the request is not submitted in writing to the Chief Engineer within not less than twenty (20) calendar days prior to the original "Incentive-Disincentive Completion Date," the Contractor must also continue to aggressively, efficiently, and effectively pursue the completion of the "Incentive-Disincentive" work. This would include the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work, until a determination is made by the Chief Engineer or twenty (20) calendar days has expired since such written request was received. There shall be no right of any kind on behalf of the Contractor to challenge or otherwise seek review or appeal, in any forum, of any determination made by the Chief Engineer under this provision.

The Contractor shall have no rights under the Contract to make any claim arising out of this incentive payment except as is expressly set forth in this Article.

As conditions precedent to the Contractor's entitlement to any "Incentive payment" the Contractor must: (1) Deliver in-hand to the Department any and all claims in full accordance with 5-12.3 and subject to the limitations therein, no later than 60 days after completion of the work on which such claim is based and tentatively schedule a Disputes Review Board hearing while awaiting Department review and response to any such claim. Furthermore, as to any such 5-12.3 claims for which the Disputes Review Board has determined entitlement, but both parties have not reached an agreement on monetary compensation prior to final acceptance, and also as to those 5-12.3 claims pending at or submitted after final acceptance, tentatively schedule a Disputes Review Board hearing within 60 calendar days after the final acceptance date while awaiting Department review and response to any such claim. The sole forum for final determination as to both entitlement and amount of monetary compensation, if not otherwise mutually resolved, or otherwise agreed, shall be the Disputes Review Board.

(2) Actually complete the "Contract Work Item" and obtain written verification of the actual completion date from the Engineer on or before the "Incentive-Disincentive Completion Date."

(3) No later than 60 days after final acceptance by the Department, the Contractor must either (a) elect to be paid the "incentive payment" pursuant to (4) below, or (b) notify the Department in writing that the Contractor is electing to be paid the "incentive payment" and is reserving one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board. The determinations of the Disputes Review Board as to any such 5-12.3 claims will be fully binding on both the Department and the Contractor, with no right of any kind of challenge, review or appeal, in any forum, by either party. Further, under (b) herein, any previous Disputes Review Board determinations on any such 5-12.3 claims issues shall then be fully binding and not subject to reconsideration by the Disputes Review Board, regardless of whether either party has previously rejected or otherwise not accepted one or more such recommendations at the time such were rendered.

SPECIAL PROVISIONS FPID(S): 408463-1-52-01, etc.

(4) The Contractor shall notify the Department in writing, within 60 days of receiving written verification of the actual completion date of the Contract Work Item by the Engineer per (2) above, that the Contractor elects to be paid the incentive payment which the Contractor is eligible to be paid based on the actual "Incentive-Disincentive Completion Date," and such written notice shall constitute a full and complete waiver, release and acknowledgment of satisfaction by the Contractor of any and all claims, causes of action, issues, demands, disputes, matters or controversies, of any nature or kind whatsoever, known or unknown, against the Department, its employees, officers, agents, representatives, consultants, and their respective employees, officers and representatives, the Contractor has or may have as to work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers or subcontractors or other Contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of the Contractor's operations, extended or unabsorbed home office or job site overhead, lump sum maintenance of traffic adjustments, lost profits, prime mark-up on subcontractor work, acceleration costs, any and all direct and indirect costs, any other adverse impacts, events, conditions, circumstances or potential damages, on or pertaining to, or as to or arising out of the Contract. This waiver, release and acknowledgment of satisfaction shall be all-inclusive and absolute, save and except any routine Department final estimating quantity adjustments.

Should the Contractor fail to actually complete the Contract Work Item and obtain written verification of the actual completion date from the Engineer prior to the "Incentive-Disincentive Completion Date," or should the Contractor, having done so, fail to timely request the "incentive payment" for any reason, and including but not limited to the Contractor choosing not to either reserve on or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board as set forth in (3)(b) above, or to fully waive, release and acknowledge satisfaction as set forth in (4) above, the Contractor shall have no right to any payment whatsoever under this Article. Notwithstanding the Contractor's election or nonelection of the "incentive payment" under this provision, the disincentive provision applies to all circumstances where the work in the Contract is not verified as completed by the Engineer in writing by the Allowable "Incentive-Disincentive Completion Date." Should the Contractor fail to complete the Contract Work Item on or before the Allowable "Incentive-Disincentive Completion Date," as adjusted in accordance with the provisions of 8-7.3, the Department shall deduct the "Incentive-Disincentive Daily Amount" for each calendar day completion exceeds the Allowable "Incentive-Disincentive Completion Date," from monies otherwise due the Contractor. The term Allowable "Incentive-Disincentive Completion Date" as used in this Article shall mean the "Incentive-Disincentive Completion Date" plus adjustments pursuant to 8-7.3. This deduction shall be the disincentive for the Contractor's failing to timely complete the Contract Work Item. Article 8-10 relating to liquidated damages remains in effect and is applicable.

In the event the Contractor elects to exercise the "incentive payment" provision, should this provision conflict with any other provision of the Contract, the Contract shall be interpreted in accordance with this provision.

As to any Contract Work Item provided for herein, the Contractor will remain responsible for all such work and the continued maintenance thereof until such date as the Department final accepts all Work under the Contract in accordance with 5-11, and without regard to whether the Department has provided written

verification of the actual completion date or not, and without regard to whether any "incentive payment" was earned or elected hereunder.

8-13.4 Pay Adjustment For Lane Closure Days.

If the Contractor closes both directions of Cassadaga Road over 1-4 to traffic, the Department will assess a per day fee as follows:

Time Frame	Per Day Fee
Contract Day 1 through March 31, 2007	$7,500 per day
April 1, 2007 through April 30, 2007	$4,000 per day
May 1, 2007 through May 31, 2007	$2,000 per day

If the Contractor fails to open both directions of Cassadaga Road over 1-4 to traffic by August 1, 2007, the Department will assess $7,500 per day fee until both directions of Cassadaga Road over 1-4 are open to traffic.

Once the traffic is open in both directions on Cassadaga Road over 1-4 to traffic, allowable lane closure restrictions apply, as specified in the contract.

The Department will have the right to apply as payment for such assessments, any money which is due to the Contractor by the Department.

Appendix H

Example Specifications for Incentive/Disincentive

FDOT Specifications

8-13.1 Incentive-Disincentive.
(REV 12-15-03) (FA 1-8-04) (7-04)

The Department desires to expedite construction on this Contract to minimize the inconvenience to the traveling public and to reduce the time of construction. In order to achieve this, incentive-disincentive provisions are established for the Contract Work Items described below. The total combined incentive payment(s) or disincentive deduction(s) shall not exceed $_____.

Contract Work Item	Incentive-Disincentive Completion Date	Incentive-Disincentive Daily Amount	Incentive-Disincentive Total Amount
Usage—describe work and tie to the plans	Alt 1 Calendar days from commencement of Contract Time. Alt 2 Date	(Amount)	(Amount)
Example: Complete project in accordance with 5-11	Alt 1 Calendar days from commencement of Contract Time. Alt 2 Date	(Amount)	(Amount)

The Department will pay the Contractor an "incentive payment" in the amount of the "Incentive-Disincentive Daily Amount" as set forth above for each calendar day the actual completion date of the "Contract Work Item" as set forth above precedes the "Incentive-Disincentive Completion Date" as set forth above, and as determined by the Engineer and subject to the conditions precedent set forth below. For purposes of the calculation and the determination of entitlement to the "incentive payment" stated above, the "Incentive-Disincentive Completion Date" will not be adjusted for any reason, cause or circumstance whatsoever, regardless of fault, save and except in the instance of a catastrophic event (i.e., hurricane or a declared state of emergency).

The parties anticipate that delays may be caused by or arise from any number of events during the course of the Contract, including, but not limited to, work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time

extensions, extra work, right of way issues, permitting issues, actions of suppliers, subcontractors or other contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of Contractor's operations, or other such events, forces or factors sometimes experienced in highway construction work. Such delays or events and their potential impacts on performance by the Contractor are specifically contemplated and acknowledged by the parties in entering into this Contract, and shall not extend the "Incentive-Disincentive Completion Date" for the purposes of calculation "incentive payment" as set forth above. Further, any and all costs or impacts whatsoever incurred by the Contractor in accelerating the Contractor's work to overcome or absorb such delays or events in an effort to complete the Contract by the "Incentive-Disincentive Completion Date," regardless of whether the Contractor successfully does so or not, shall be the sole responsibility of the Contractor in every instance.

In the event of a catastrophic event (i.e., hurricane or a declared state of emergency) directly and substantially affecting the Contractor's operations on the Contract, the Contractor and the Department shall agree as to the number of calendar days to extend the "Incentive-Disincentive Completion Date" so that such extended "Incentive-Disincentive Completion Date" will be used in calculation of the "incentive payment." In the event the Contractor and Department are unable to agree to the number of calendar days to extend the "Incentive-Disincentive Completion Date," the Department will unilaterally determine the number of calendar days to extend the "Incentive-Disincentive Completion Date" reasonably necessary and due solely to such catastrophic event and the Contractor shall have no right whatsoever to contest such determination, save and except that the Contractor establishes that the number of calendar days determined by the Department was arbitrary or without any reasonable basis.

However, notwithstanding anything above to the contrary, upon the Contractor's written request being made directly to the Chief Engineer, with copies provided to both the Resident Construction Engineer and the District Construction Engineer, the Department reserves unto the Chief Engineer, in his sole and absolute discretion, according to the parameters set forth below, the authority to make a determination to either fully enforce the above provisions with no modification, modify the "Incentive-Disincentive Completion Date" by moving it, or both modify the "Incentive-Disincentive Completion Date" by moving it and also modify the "incentive payment" amount by reducing it.

No modification of an "Incentive-Disincentive" provision will be considered by the Chief Engineer for any impacts whatsoever, beyond the reasonable control of the Contractor, for which the effect results in a time extension of less than 15% of the time remaining in the period from the first day of occurrence of such impact to the "Incentive-Disincentive Completion Date." Furthermore, as to any such impact, for which the effect results in a Time Extension of 15% or more of the time remaining in the period from the first day of occurrence of such impact to the "Incentive-Disincentive Completion Date," no modification of an "Incentive-Disincentive" provision will be considered by the Chief Engineer unless the Contractor clearly establishes that it has continuously from the beginning of the project aggressively, efficiently and effectively pursued the achievement of the "incentive payment." This would include the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work so as to still achieve the "incentive payment," and that, but for this impact, the contractor would have otherwise earned the "incentive payment" provided in the original Contract. Also, to the extent the request is not submitted in writing to the Chief Engineer within not less than twenty (20) calendar days prior to the original "Incentive-Disincentive Completion Date," the Contractor must also continue to aggressively, efficiently, and effectively pursue the completion of the "Incentive-Disincentive" work. This would include the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work,

until a determination is made by the Chief Engineer or twenty (20) calendar days has expired since such written request was received. There shall be no right of any kind on behalf of the Contractor to challenge or otherwise seek review or appeal, in any forum, of any determination made by the Chief Engineer under this provision.

The Contractor shall have no rights under the Contract to make any claim arising out of this incentive payment except as is expressly set forth in this Article.

As conditions precedent to the Contractor's entitlement to any "Incentive payment" the Contractor must: (1) Deliver in-hand to the Department any and all claims in full accordance with 5-12.3 and subject to the limitations therein, no later than 60 days after completion of the work on which such claim is based and tentatively schedule a Disputes Review Board hearing while awaiting Department review and response to any such claim. Furthermore, as to any such 5-12.3 claims for which the Disputes Review Board has determined entitlement, but both parties have not reached an agreement on monetary compensation prior to final acceptance, and also as to those 5-12.3 claims pending at or submitted after final acceptance, tentatively schedule a Disputes Review Board hearing within 60 calendar days after the final acceptance date while awaiting Department review and response to any such claim. The sole forum for final determination as to both entitlement and amount of monetary compensation, if not otherwise mutually resolved, or otherwise agreed, shall be the Disputes Review Board.

(2) Actually complete the "Contract Work Item" and obtain written verification of the actual completion date from the Engineer on or before the "Incentive-Disincentive Completion Date."

(3) No later than 60 days after final acceptance by the Department, the Contractor must either (a) elect to be paid the "incentive payment" pursuant to (4) below, or (b) notify the Department in writing that the Contractor is electing to be paid the "incentive payment" and is reserving one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board. The determinations of the Disputes Review Board as to any such 5-12.3 claims will be fully binding on both the Department and the Contractor, with no right of any kind of challenge, review or appeal, in any forum, by either party. Further, under (b) herein, any previous Disputes Review Board determinations on any such 5-12.3 claims issues shall then be fully binding and not subject to reconsideration by the Disputes Review Board, regardless of whether either party has previously rejected or otherwise not accepted one or more such recommendations at the time such were rendered.

(4) The Contractor shall notify the Department in writing, within 60 days of receiving written verification of the actual completion date of the Contract Work Item by the Engineer per (2) above, that the Contractor elects to be paid the incentive payment which the Contractor is eligible to be paid based on the actual "Incentive-Disincentive Completion Date," and such written notice shall constitute a full and complete waiver, release and acknowledgment of satisfaction by the Contractor of any and all claims, causes of action, issues, demands, disputes, matters or controversies, of any nature or kind whatsoever, known or unknown, against the Department, its employees, officers, agents, representatives, consultants, and their respective employees, officers and representatives, the Contractor has or may have as to work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers or subcontractors or other Contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of the Contractor's operations, extended or unabsorbed home

office or job site overhead, lump sum maintenance of traffic adjustments, lost profits, prime mark-up on subcontractor work, acceleration costs, any and all direct and indirect costs, any other adverse impacts, events, conditions, circumstances or potential damages, on or pertaining to, or as to or arising out of the Contract. This waiver, release and acknowledgment of satisfaction shall be all-inclusive and absolute, save and except any routine Department final estimating quantity adjustments.

Should the Contractor fail to actually complete the Contract Work Item and obtain written verification of the actual completion date from the Engineer prior to the "Incentive-Disincentive Completion Date," or should the Contractor, having done so, fail to timely request the "incentive payment" for any reason, and including but not limited to the Contractor choosing not to either reserve one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board as set forth in (3)(b) above, or to fully waive, release and acknowledge satisfaction as set forth in (4) above, the Contractor shall have no right to any payment whatsoever under this Article. Notwithstanding the Contractor's election or non-election of the "incentive payment" under this provision, the disincentive provision applies to all circumstances where the work in the Contract is not verified as completed by the Engineer in writing by the Allowable "Incentive-Disincentive Completion Date."

Should the Contractor fail to complete the Contract Work Item on or before the Allowable "Incentive-Disincentive Completion Date," as adjusted in accordance with the provisions of 8-7.3, the Department shall deduct the "Incentive-Disincentive Daily Amount" for each calendar day completion exceeds the Allowable "Incentive-Disincentive Completion Date," from monies otherwise due the Contractor. The term Allowable "Incentive-Disincentive Completion Date" as used in this Article shall mean the "Incentive-Disincentive Completion Date" plus adjustments pursuant to 8-7.3. This deduction shall be the disincentive for the Contractor's failing to timely complete the Contract Work Item. Article 8-10 relating to liquidated damages remains in effect and is applicable.

In the event the Contractor elects to exercise the "incentive payment" provision, should this provision conflict with any other provision of the Contract, the Contract shall be interpreted in accordance with this provision.

As to any Contract Work Item provided for herein, the Contractor will remain responsible for all such work and the continued maintenance thereof until such date as the Department final accepts all Work under the Contract in accordance with 5-11, and without regard to whether the Department has provided written verification of the actual completion date or not, and without regard to whether any "incentive payment" was earned or elected hereunder.

8-13.1 Incentive-Disincentive.
(REV 7-27-04) (FA 7-28-04) (1-05)

The Department desires to expedite construction on this Contract to minimize the inconvenience to the traveling public and to reduce the time of construction. In order to achieve this, an incentive-disincentive provision is established for the Contract. The total "incentive payment" or disincentive deduction shall not exceed $_____.

The Department will pay the Contractor an "incentive payment" in the amount of $_____, for each calendar day the actual completion date precedes the Original Contract Time and subject to the conditions precedent set forth below. The term "Original Contract Time" as used in this Article will mean the number

of calendar days established for completion of the work in the Contract on the date the Contract was executed. The term "calendar day" as used in this Article will mean every day shown on the calendar. Calendar days will be consecutively counted from commencement of Contract Time regardless of weather, weekends, holidays, suspensions of Contractor's operations, delays or other events as described herein. For purposes of the calculation and the determination of entitlement to the "incentive payment" stated above, the Original Contract Time will not be adjusted for any reason, cause or circumstance whatsoever, regardless of fault, save and except in the instance of a catastrophic event (i.e., hurricane or a declared state of emergency).

The parties anticipate that delays may be caused by or arise from any number of events during the course of the Contract, including, but not limited to, work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers, subcontractors or other contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of Contractor's operations, or other such events, forces or factors sometimes experienced in highway construction work. Such delays or events and their potential impacts on performance by the Contractor are specifically contemplated and acknowledged by the parties in entering into this Contract, and shall not extend the Original Contract Time for purposes of calculation of the "incentive payment" set forth above. Further, any and all costs or impacts whatsoever incurred by the Contractor in accelerating the Contractor's work to overcome or absorb such delays or events in an effort to complete the Contract prior to expiration of the Original Contract Time, regardless of whether the Contractor successfully does so or not, shall be the sole responsibility of the Contractor in every instance.

In the event of a catastrophic event (i.e., hurricane or a declared state of emergency) directly and substantially affecting the Contractor's operations on the Contract, the Contractor and the Department shall agree as to the number of calendar days to extend the Original Contract Time so that such extended Original Contract Time will be used in calculation of the "incentive payment." In the event the Contractor and Department are unable to agree to the number of Calendar Days to extend the Original Contract Time, the Department will unilaterally determine the number of calendar days to extend the Original Contract Time reasonably necessary and due solely to such catastrophic event and the Contractor shall have no right whatsoever to contest such determination, save and except that the Contractor establishes that the number of calendar days determined by the Department was arbitrary or without any reasonable basis.

However, notwithstanding anything above to the contrary, upon the Contractor's written request being made directly to the Chief Engineer, with copies provided to both the Resident Construction Engineer and the District Construction Engineer, the Department reserves unto the Chief Engineer, in his sole and absolute discretion, according to the parameters set forth below, the authority to make a determination to either fully enforce the above provisions with no modification, modify the "Original Contract Time" by moving it, or both modify the "Original Contract Time" by moving it and also modify the "incentive amount" by reducing it.

No modification of this "Incentive-Disincentive" provision will be considered by the Chief Engineer for any impacts, whatsoever, beyond the reasonable control of the Contractor, for which the effect results in a time extension of less that 15% of the time remaining in the period from the first day of occurrence of such impact to the expiration of the "Original Contract Time." Furthermore, as to any such impact, for which

the effect results in a time extension of 15% or more of the time remaining in the period from the first day of occurrence of such impact to the expiration of the "Original Contract Time," no modification of this "Incentive-Disincentive" provision will be considered by the Chief Engineer unless the Contractor clearly establishes that it has continuously from the beginning of the project aggressively, efficiently and effectively pursued the achievement of the "incentive payment." This would include the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work so as to still achieve the "incentive payment," and that, but for this impact, the Contractor would have otherwise earned the "incentive payment" provided in the original Contract. Also, to the extent the request is not submitted in writing to the Chief Engineer within not less than twenty (20) calendar days prior to the expiration of the "Original Contract Time," the Contractor must also continue to aggressively, efficiently, and effectively pursue the completion of the "Incentive-Disincentive" work. This would include the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work, until a determination is made by the Chief Engineer or twenty (20) calendar days has expired since such written request was received by the Chief Engineer. There shall be no right of any kind on behalf of the Contractor to challenge or otherwise seek review or appeal in any forum, of any determination made by the Chief Engineer under this provision.

The Contractor shall have no rights under the Contract to make any claim arising out of this incentive payment provision except as is expressly set forth in this Article.

As conditions precedent to the Contractor's entitlement to any "incentive payment" the Contractor must: (1) Deliver in-hand to the Department any and all claims, in full accordance with 5-12.3 and subject to the limitations therein, no later than 60 calendar days after completion of the work on which such claim is based and tentatively schedule a Disputes Review Board hearing while awaiting Department review and response to any such claim. Furthermore, as to any such 5-12.3 claims for which the Disputes Review Board has determined entitlement, but both parties have not reached an agreement on monetary compensation prior to final acceptance, and also as to those 5-12.3 claims pending at final acceptance, tentatively schedule a Disputes Review Board hearing within 60 calendar days after the final acceptance date while awaiting Department review and response to any such claim. The sole forum for final determination as to both entitlement and amount of monetary compensation, if not otherwise mutually resolved or otherwise agreed, shall be the Disputes Review Board.

(2) Actually complete the Contract and obtain final acceptance by the Department prior to expiration of the Original Contract Time.

(3) No later than 60 days after final acceptance by the Department, the Contractor must either (a) elect to be paid the "incentive payment" pursuant to (4) below, or (b) notify the Department in writing that the Contractor is electing to be paid the "incentive payment" and is reserving one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board. The determinations of the Disputes Review Board as to any such 5-12.3 claims will be fully binding on both the Department and the Contractor, with no right of any kind of challenge, review or appeal, in any forum, by either party. Further, under (b) herein, any previous Disputes Review Board determinations on any such 5-12.3 claims issues shall then be fully binding and not subject to reconsideration by the Disputes Review Board, regardless of whether either party has previously rejected or otherwise not accepted one or more such recommendations at the time such were rendered.

(4) The Contractor shall notify the Department in writing, within 60 days after final acceptance of the

Contract by the Department, that the Contractor elects to be paid the "incentive payment" which the Contractor is eligible to be paid based on the actual final acceptance date, and such written notice shall constitute a full and complete waiver, release and acknowledgment of satisfaction by the Contractor of any and all claims, causes of action, issues, demands, disputes, matters or controversies, of any nature or kind whatsoever, known or unknown, against the Department, its employees, officers, agents, representatives, consultants, and their respective employees, officers and representatives, the Contractor has or may have, including, but not limited to, work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers or subcontractors or other contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of the Contractor's operations, extended or unabsorbed home office or job site overhead, lump sum maintenance of traffic adjustments, lost profits, prime mark-up on subcontractor work, acceleration costs, any and all direct and indirect costs, any other adverse impacts, events, conditions, circumstances or potential damages, on or pertaining to, or as to or arising out of the Contract. This waiver, release and acknowledgment of satisfaction shall be all-inclusive and absolute, save and except any routine Department final estimating quantity adjustments.

Should the Contractor fail to actually complete the Contract and obtain final acceptance by the Department prior to expiration of the Original Contract Time, or should the Contractor, having timely completed the Contract and obtained final acceptance by the Department prior to expiration of the Original Contract Time but having failed to timely request the "incentive payment" for any reason, and including but not limited to the Contractor choosing not to either reserve one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board as set forth in (3)(b) above, or to fully waive, release and acknowledge satisfaction as set forth in (4) above, the Contractor shall have no right to any payment whatsoever under this Article. Notwithstanding the Contractor's election or non-election of the "incentive payment" under this provision, the disincentive provision applies to all circumstances where the work in the Contract is not finally accepted by the Allowable Contract Time.

Completion and acceptance of the Contract for purposes of this Article shall be in accordance with 5-11.

Should the Contractor fail to complete the Contract on or before expiration of the Allowable Contract Time, as adjusted in accordance with the provisions of 8-7.3, the Department shall deduct $_____ for each calendar day completion exceeds the Allowable Contract Time, from the monies otherwise due the Contractor. The term "Allowable Contract Time" as used in this Article shall mean the Original Contract Time plus adjustments pursuant to 8-7.3. This deduction shall be the disincentive for the Contractor's failing to timely complete the Contract. Article 8-10 relating to liquidated damages remains in effect and is applicable.

In the event the Contractor elects to exercise this "incentive payment" provision, should this provision conflict with any other provision of the Contract, the Contract shall be interpreted in accordance with this provision.

8-13.1 Incentive-Disincentive for A+B.
(REV 7-27-04) (FA 7-28-04) (1-05)

The Department desires to expedite construction on this Contract to minimize the inconvenience to the

traveling public and to reduce the time of construction. In order to achieve this, an incentive-disincentive provision is established for the Contract. The total incentive payment or disincentive deduction shall not exceed $_____.

In the event the Contractor completes the Contract prior to the expiration of the Original Contract Time, the Department will pay the Contractor an incentive payment in the Daily Value amount specified in provision 3-1 for each calendar day the actual completion date precedes the Original Contract Time and subject to the conditions precedent set forth below. The term "Original Contract Time" as used in this Article will mean the number of calendar days established for completion of the work in the Contract on the date the Contract was executed. The term "calendar day" as used in this Article will mean every day shown on the calendar. Calendar days will be consecutively counted from commencement of Contract Time regardless of weather, weekends, holidays, suspensions of Contractor's operations, delays or other events as described herein. For purposes of the calculation and the determination of entitlement to the "incentive payment" stated above, the Original Contract Time will not be adjusted for any reason, cause or circumstance whatsoever, regardless of fault, save and except in the instance of a catastrophic event (i.e., hurricane or a declared state of emergency).

The parties anticipate that delays may be caused by or arise from any number of events during the course of the Contract, including, but not limited to, work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers, subcontractors or other contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of Contractor's operations, or other such events, forces or factors sometimes experienced in highway construction work. Such delays or events and their potential impacts on performance by the Contractor are specifically contemplated and acknowledged by the parties in entering into this Contract, and shall not extend the Original Contract Time for purposes of calculation of the "incentive payment" set forth above. Further, any and all costs or impacts whatsoever incurred by the Contractor in accelerating the Contractor's work to overcome or absorb such delays or events in an effort to complete the Contract prior to expiration of the Original Contract Time, regardless of whether the Contractor successfully does so or not, shall be the sole responsibility of the Contractor in every instance.

In the event of a catastrophic event (i.e., hurricane or a declared state of emergency) directly and substantially affecting the Contractor's operations on the Contract, the Contractor and the Department shall agree as to the number of calendar days to extend the Original Contract Time so that such extended Original Contract Time will be used in calculation of the "incentive payment." In the event the Contractor and Department are unable to agree to the number of calendar days to extend the Original Contract Time, the Department shall unilaterally determine the number of calendar days to extend the Original Contract Time reasonably necessary and due solely to such catastrophic event and the Contractor shall have no right whatsoever to contest such determination, save and except that the Contractor establishes that the number of calendar days determined by the Department was arbitrary or without any reasonable basis.

However, notwithstanding anything above to the contrary, upon the Contractor's written request being made directly to the Chief Engineer, with copies provided to both the Resident Construction Engineer and the District Construction Engineer, the Department reserves unto the Chief Engineer, in his sole and absolute discretion, according to the parameters set forth below, the authority to make a determination

to either fully enforce the above provisions with no modification, modify the "Original Contract Time" by moving it, or both modify the "Original Contract Time" by moving it and also modify the "incentive payment" amount by reducing it.

No modification of this "Incentive-Disincentive" provision will be considered by the Chief Engineer for any impacts, whatsoever, beyond the reasonable control of the Contractor, the effect of which results in a time extension of less that 15% of the time remaining in the period from first day of occurrence of such impact to the "Original Contract Time." Furthermore, as to any such impact, the effect of which results in a time extension of 15% or more of the time remaining in the period from first day of occurrence of such impact to the "Original Contract Time," no modification of this "Incentive-Disincentive" provision will be considered by the Chief Engineer unless the Contractor clearly establishes that it has continuously from the beginning of the project aggressively, efficiently and effectively pursued the achievement of the "incentive payment," including the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work so as to still achieve the "incentive payment," and that, but for this impact, the Contractor would have otherwise earned the "incentive payment" provided in the original Contract. Also, to the extent the request is not submitted in writing to the Chief Engineer within not less than twenty (20) calendar days prior to the original "Original Contract Time," the Contractor must also continue to aggressively, efficiently, and effectively pursue the completion of the "Incentive-Disincentive" work, including the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work, until a determination is made by the Chief Engineer or twenty (20) calendar days has expired since such written request was received by the Chief Engineer. There shall be no right of any kind on behalf of the Contractor to challenge or otherwise seek review or appeal in any forum of any determination made by the Chief Engineer under this provision.

The Contractor shall have no rights under the Contract to make any claim arising out of this "incentive payment" provision except as is expressly set forth in this Article.

As conditions precedent to the Contractor's entitlement to any "incentive payment" the Contractor must: (1) Deliver in-hand to the Department any and all claims, in full accordance with 5-12.3 and subject to the limitations therein, no later than 60 calendar days after completion of the work on which such claim is based and tentatively schedule a Disputes Review Board hearing while awaiting Department review and response to any such claim. Furthermore, as to any such 5-12.3 claims for which the Disputes Review Board has determined entitlement but both parties have not reached an agreement on monetary compensation prior to final acceptance, and also as to those 5-12.3 claims pending at final acceptance, tentatively schedule a Disputes Review Board hearing within 60 calendar days of the final acceptance while awaiting Department review and response to any such claim; and the sole forum for final determination as to both entitlement and amount of monetary compensation, if not otherwise mutually resolved or otherwise agreed, shall be the Disputes Review Board.

(2) Actually complete the Contract and obtain final acceptance by the Department prior to expiration of the Original Contract Time.

(3) No later than 60 days after final acceptance by the Department, the Contractor must either (a) elect to be paid the "incentive payment" pursuant to (4) below, or (b) notify the Department in writing that the Contractor is electing to be paid the "incentive payment" and is reserving one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board. The determinations of the

Disputes Review Board as to any such 5-12.3 claims will be fully binding on both the Department and the Contractor, with no right of any kind of challenge, review or appeal in any forum by either party. Further, under (b) herein, any previous Disputes Review Board determinations on any such 5-12.3 claims issues shall then be fully binding and not subject to reconsideration by the Disputes Review Board, regardless of whether either party has previously rejected or otherwise not accepted one or more such recommendations at the time such were rendered.

(4) The Contractor shall notify the Department in writing, within 60 days after final acceptance of the Contract by the Department, that the Contractor elects to be paid the "incentive payment" which the Contractor is eligible to be paid based on the actual final acceptance date, and such written notice shall constitute a full and complete waiver, release and acknowledgment of satisfaction by the Contractor of any and all claims, causes of action, issues, demands, disputes, matters or controversies, of any nature or kind whatsoever, known or unknown, against the Department, its employees, officers, agents, representatives, consultants, and their respective employees, officers and representatives, the Contractor has or may have, including, but not limited to, work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers or subcontractors or other contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of Contractor's operations, extended or unabsorbed home office or job site overhead, lump sum maintenance of traffic adjustments, lost profits, prime mark-up on subcontractor work, acceleration costs, any and all direct and indirect costs, any other adverse impacts, events, conditions, circumstances or potential damages, on or pertaining to, or as to or arising out of the Contract. This waiver, release and acknowledgment of satisfaction shall be all-inclusive and absolute, save and except any routine Department final estimating quantity adjustments.

Should the Contractor fail to actually complete the Contract and obtain final acceptance by the Department prior to expiration of the Original Contract Time, or should the Contractor, having timely completed the Contract and obtained final acceptance by the Department prior to expiration of the Original Contract Time but having failed to timely request the "incentive payment" for any reason, and including but not limited to the Contractor choosing not to fully waive, release and acknowledge satisfaction as set forth in (4) above, the Contractor shall have no right to any payment whatsoever under this Article. Notwithstanding the Contractor's election or non-election of the incentive under this provision, the disincentive provision applies to all circumstances where the work in the Contract is not finally accepted by the Allowable Contract Time.

Completion and acceptance of the Contract for purposes of this Article shall be in accordance with 5-11.

Should the Contractor fail to complete the Contract on or before expiration of the Allowable Contract Time, as adjusted in accordance with the provisions of 8-7.3, the Department shall deduct from the monies due the Contractor the Daily Value as shown in provision 3-1 for each calendar day completion exceeds the Allowable Contract Time. The term "Allowable Contract Time" as used in this Article shall mean the Original Contract Time plus adjustments pursuant to 8-7.3. This deduction shall be the disincentive for the Contractor's failing to timely complete the Contract. Article 8-10 relating to liquidated damages remains in effect and is applicable.

In the event the Contractor elects to exercise this "incentive payment" provision, should this provision conflict with any other provision of the Contract, the Contract shall be interpreted in accordance with this provision.

Appendix I

Example Specifications for Bonus

FDOT Specifications

8-13.1 "Bonus" Payment and Waiver of Contractor Claims.
(REV 5-19-04) (FA 7-13-04) (1-05)

The Department will pay the Contractor a "Bonus" in the amount of $_____, if the work in the Contract is completed in accordance with 5-11, as determined by the Engineer, on or before the "Bonus Completion Date," and subject to the conditions precedent set forth below. The term "Bonus Completion Date" as used in this Article shall mean (1) _____ calendar days from commencement of Contract Time, or (2) the number of calendar days bid by the Contractor in the A + B proposal, whichever is less. The term "calendar day" as used in this Article shall mean every day shown on the calendar. Calendar days will be consecutively counted from commencement of Contract Time regardless of weather, weekends, holidays, suspensions of Contractor's operations, delays or other events as described herein. For purposes of the calculation and the determination of entitlement to the "Bonus" stated above, the "Bonus" Completion Date will not be adjusted for any reason, cause or circumstance whatsoever, regardless of fault, save and except in the instance of a catastrophic event (i.e., hurricanes or a declared state of emergency).

The parties anticipate that delays may be caused by or arise from any number of events during the course of the Contract, including, but not limited to, work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of Suppliers, Subcontractors or other Contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of Contractor's operations, or other such events, forces or factors sometimes experienced in highway construction work. Such delays or events and their potential impacts on performance by the Contractor are specifically contemplated and acknowledged by the parties in entering into this Contract, and shall not extend the "Bonus Completion Date" set forth above. Further, any and all costs or impacts whatsoever incurred by the Contractor in accelerating the Contractor's work to overcome or absorb such delays or events in an effort to complete the Contract by the "Bonus Completion Date," regardless of whether the Contractor successfully does so or not, shall be the sole responsibility of the Contractor in every instance.

In the event of a catastrophic event (i.e., hurricane or a declared state of emergency) directly and substantially affecting the Contractor's operations on the Contract, the Contractor and the Department shall agree as to the number of calendar days to extend the "Bonus Completion Date." In the event the Contractor and Department are unable to agree to the number of calendar days to extend the "Bonus Completion Date," the Department shall unilaterally determine the number of calendar days to extend the "Bonus" Completion Date reasonably necessary and due solely to such catastrophic event and the Contractor shall have no right whatsoever to contest such determination, save and except that the Contractor establishes that the number of calendar days determined by the Department was arbitrary or without any reasonable basis.

However, notwithstanding anything above to the contrary, upon the Contractor's written request being made directly to the Chief Engineer, with copies provided to both the Resident Construction Engineer

and the District Construction Engineer, the Department reserves unto the Chief Engineer, in his sole and absolute discretion, according to the parameters set forth below, the authority to make a determination to either fully enforce the above provisions with no modification, modify the "Bonus Completion Date" by moving it, or both modify the "Bonus Completion Date" by moving it and also modify the "Bonus" amount by reducing it.

No modification of a "Bonus" provision will be considered by the Chief Engineer for any impacts whatsoever, beyond the reasonable control of the Contractor, for which the effect results in a time extension of less than 15% of the time remaining in the period from the first day of occurrence of such impact to the "Bonus Completion Date." Furthermore, as to any such impact, for which the effect results in a time extension of 15% or more of the time remaining in the period from the first day of occurrence of such impact to the "Bonus Completion Date," no modification of a "Bonus" provision will be considered by the Chief Engineer unless the contractor clearly establishes that it has continuously from the beginning of the project aggressively, efficiently and effectively pursued the achievement of the "Bonus." This would include the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work so as to still achieve the "Bonus," and that, but for this impact, the Contractor would have otherwise earned the "Bonus" provided in the original Contract. Also, to the extent the request is not submitted in writing to the Chief Engineer within not less than twenty (20) calendar days prior to the original "Bonus Completion Date," the Contractor must also continue to aggressively, efficiently, and effectively pursue the completion of the "Bonus" work. This would include the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work, until a determination is made by the Chief Engineer or twenty (20) calendar days has expired since such written request was received by the Chief Engineer. There shall be no right of any kind on behalf of the Contractor to challenge or otherwise seek review or appeal, in any forum, any determination made by the Chief Engineer under this provision.

The Contractor shall have no rights under the Contract to make any claim arising out of this "Bonus" provision except as is expressly set forth in this Article.

As conditions precedent to the Contractor's entitlement to any "Bonus" the Contractor must:
(1) Deliver in-hand to the Department any and all claims, in full accordance with 5-12.3 and subject to the limitations therein, no later than 60 calendar days after completion of the work on which such claim is based and tentatively schedule a Disputes Review Board hearing while awaiting Department review and response to any such claim. Furthermore, as to any such 5-12.3 claims for which the Disputes Review Board has determined entitlement but both parties have not reached an agreement on monetary compensation prior to final acceptance, and also as to those 5-12.3 claims pending at or submitted after final acceptance, tentatively schedule a Disputes Review Board hearing within 60 calendar days after the final acceptance date while awaiting Department review and response to any such claim. The sole forum for final determination as to both entitlement and amount of monetary compensation, if not otherwise mutually resolved or otherwise agreed, shall be the Disputes Review Board.

(2) Actually complete the Contract and obtain final acceptance by the Department, as determined by the Engineer in accordance with 5-11.

(3) No later than 60 days after final acceptance by the Department, the Contractor must either (a) elect to be paid the "Bonus" pursuant to (4) below, or (b) notify the Department in writing that the Contractor is electing to be paid the "Bonus" and is reserving one or more outstanding 5-12.3 claims for final and fully

binding determination by the Disputes Review Board. The determinations of the Disputes Review Board as to any such 5-12.3 claims will be fully binding on both the Department and the Contractor, with no right of any kind of challenge, review or appeal, in any forum, by either party. Further, under (b) herein, any previous Disputes Review Board determinations on any such 5-12.3 claims issues shall then be fully binding and not subject to reconsideration by the Disputes Review Board, regardless of whether either party has previously rejected or otherwise not accepted one or more such recommendations at the time such were rendered.

(4) The Contractor shall notify the Department in writing, within 60 days of the final acceptance of the work in the Contract by the Department, that the Contractor elects to be paid the "Bonus" which the Contractor is eligible to be paid based on the actual final acceptance date, and such written notice shall constitute a full and complete waiver, release and acknowledgment of satisfaction by the Contractor of any and all claims, causes of action, issues, demands, disputes, matters or controversies, of any nature or kind whatsoever, known or unknown, against the Department, its employees, officers, agents, representatives, consultants, and their respective employees, officers and representatives, the Contractor has or may have as to work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers or subcontractors or other Contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of the Contractor's operations, extended or unabsorbed home office or job site overhead, lump sum maintenance of traffic adjustments, lost profits, prime mark-up on subcontractor work, acceleration costs, any and all direct and indirect costs, any other adverse impacts, events, conditions, circumstances or potential damages, on or pertaining to, or as to or arising out of the Contract. This waiver, release and acknowledgment of satisfaction shall be all-inclusive and absolute, save and except any routine Department final estimating quantity adjustments.

Should the Contractor fail to actually complete the Contract and obtain final acceptance by the Department as determined by the Engineer in accordance with 5-11, or should the Contractor, having done so, fail to timely request the "Bonus" for any reason, and including but not limited to the Contractor choosing not to either reserve one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board as set forth in (3)(b) above, or to fully waive, release and acknowledge satisfaction as set forth in (4) above, the Contractor shall have no right to any payment whatsoever under this Article.

In the event the Contractor elects to exercise the "Bonus Payment" provision, should this provision conflict with any other provision of the Contract, the Contract shall be interpreted in accordance with this provision.

8-13.1 "Bonus" Payment and Waiver of Contractor Claims.
(REV 7-27-04) (FA 7-28-04) (1-05)

The Department will pay the Contractor a "Bonus" in the amount of $_____, if the work in the Contract is completed in accordance with 5-11, as determined by the Engineer, on or before _____("Bonus Completion Date") and subject to the conditions precedent set forth below. For purposes of the calculation and the determination of entitlement to the "Bonus" stated above, the "Bonus Completion Date" will not be adjusted for any reason, cause or circumstance whatsoever, regardless of fault, save and except in the instance of a catastrophic event (i.e., hurricane or a declared state of emergency).

The parties anticipate that delays may be caused by or arise from any number of events during the course

of the Contract, including, but not limited to, work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers, subcontractors or other contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of Contractor's operations, or other such events, forces or factors sometimes experienced in highway construction work. Such delays or events and their potential impacts on performance by the Contractor are specifically contemplated and acknowledged by the parties in entering into this Contract, and shall not extend the "Bonus Completion Date" set forth above. Further, any and all costs or impacts whatsoever incurred by the Contractor in accelerating the Contractor's work to overcome or absorb such delays or events in an effort to complete the Contract by the "Bonus Completion Date," regardless of whether the Contractor successfully does so or not, shall be the sole responsibility of the Contractor in every instance.

In the event of a catastrophic event (i.e., hurricane or a declared state of emergency) directly and substantially affecting the Contractor's operations on the Contract, the Contractor and the Department shall agree as to the number of calendar days to extend the "Bonus Completion Date." In the event the Contractor and Department are unable to agree to the number of calendar days to extend the "Bonus Completion Date," the Department shall unilaterally determine the number of calendar days to extend the "Bonus Completion Date" reasonably necessary and due solely to such catastrophic event and the Contractor shall have no right whatsoever to contest such determination, save and except that the Contractor establishes that the number of calendar days determined by the Department was arbitrary or without any reasonable basis.

However, notwithstanding anything above to the contrary, upon the Contractor's written request being made directly to the Chief Engineer, with copies provided to both the Resident Construction Engineer and the District Construction Engineer, the Department reserves unto the Chief Engineer, in his sole and absolute discretion, according to the parameters set forth below, the authority to make a determination to either fully enforce the above provisions with no modification, modify the "Bonus Completion Date" by moving it, or both modify the "Bonus Completion Date" by moving it and also modifying the "Bonus" amount by reducing it.

No modification of a "Bonus" provision will be considered by the Chief Engineer for any impacts whatsoever, beyond the reasonable control of the Contractor, the effect of which results in a time extension of less that 15% of the time remaining in the period from first day of occurrence of such impact to the "Bonus Completion Date." Furthermore, as to any such impact, the effect of which results in a time extension of 15% or more of the time remaining in the period from first day of occurrence of such impact to the "Bonus Completion Date," no modification of a "Bonus" provision will be considered by the Chief Engineer unless the Contractor clearly establishes that it has continuously from the beginning of the project aggressively, efficiently and effectively pursued the achievement of the "Bonus," including the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work so as to still achieve the "Bonus," and, but for this impact, the Contractor would have otherwise earned the "Bonus" provided in the original Contract. Also, to the extent the request is not submitted in writing to the Chief Engineer within not less than twenty (20) calendar days prior to the original "Bonus Completion Date," the Contractor must also continue to aggressively, efficiently, and effectively pursue the completion of the "Bonus" work, including the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work, until a determination is made by the Chief Engineer or twenty (20) calendar days has expired since such written notice. There shall be no right of any kind on behalf of the

Contractor to challenge or otherwise seek review or appeal in any forum of any determination made by the Chief Engineer under this provision.

The Contractor shall have no rights under the Contract to make any claim arising out of this "Bonus" provision except as is expressly set forth in this Article.

As conditions precedent to the Contractor's entitlement to any "Bonus" the Contractor must:
(1) Deliver in-hand to the Department any and all claims, in full accordance with 5-12.3 and subject to the limitations therein, no later than 60 calendar days after completion of the work on which such claim is based and tentatively schedule a Disputes Review Board hearing while awaiting Department review and response to any such claim. Furthermore, as to any such 5-12.3 claims for which the Disputes Review Board has determined entitlement but both parties have not reached an agreement on monetary compensation prior to final acceptance, and those 5-12.3 claims pending at or submitted after final acceptance, tentatively schedule a Disputes Review Board hearing within 60 calendar days of the final acceptance while awaiting Department review and response to any such claim and the sole forum for final determination as to both entitlement and amount of monetary compensation, if not otherwise mutually resolved or otherwise agreed, shall be the Disputes Review Board.

(2) Actually complete the Contract and obtain final acceptance by the Department, as determined by the Engineer in accordance with 5-11, on or before the "Bonus Completion Date."

(3) No later than 60 days after final acceptance by the Department, the Contractor must either (a) elect to be paid the "Bonus" pursuant to (4) below, or (b) notify the Department in writing that the Contractor is electing to be paid the "Bonus" and is reserving one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board. The determinations of the Disputes Review Board as to any such 5-12.3 claims will be fully binding on both the Department and the Contractor, with no right of any kind of challenge, review or appeal in any forum by either party. Further, under (b) herein, any previous Disputes Review Board determinations on any such 5-12.3 claims issues shall then be fully binding and not subject to reconsideration by the Disputes Review Board, regardless of whether either party had previously rejected or otherwise not accepted one or more such recommendations at the time such were rendered.

(4) The Contractor shall notify the Department in writing, within 60 days of the final acceptance of the work in the Contract by the Department, that the Contractor elects to be paid the "Bonus" which the Contractor is eligible to be paid based on the actual final acceptance date, and such written notice shall constitute a full and complete waiver, release and acknowledgment of satisfaction by the Contractor of any and all claims, causes of action, issues, demands, disputes, matters or controversies, of any nature or kind whatsoever, known or unknown, against the Department, its employees, officers, agents, representatives, consultants, and their respective employees, officers and representatives, the Contractor has or may have as to work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers or subcontractors or other contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of the Contractor's operations, extended or unabsorbed home office or job site overhead, lump sum maintenance of traffic adjustments, lost profits, prime mark-up on subcontractor work, acceleration costs, any and all direct and indirect costs, any other adverse impacts, events, conditions, circumstances or potential damages, on or pertaining to, or as to or

arising out of the Contract. This waiver, release and acknowledgment of satisfaction shall be all-inclusive and absolute, save and except any routine Department final estimating quantity adjustments.

Should the Contractor fail to actually complete the Contract and obtain final acceptance by the Department as determined by the Engineer in accordance with 5-11, on or before the "Bonus Completion Date," or should the Contractor, having done so, fail to timely request the "Bonus" for any reason, and including but not limited to the Contractor choosing not to either reserve one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board as set forth in (3)(b) above, or to fully waive, release and acknowledge satisfaction as set forth in (4) above, the Contractor shall have no right to any payment whatsoever under this Article.

In the event the Contractor elects to exercise the "Bonus Payment" provision, should this provision conflict with any other provision of the Contract, the Contract shall be interpreted in accordance with this provision.

8-13.1 "Bonus" Payment and Waiver of Contractor Claims.
(REV 7-27-04) (FA 7-28-04) (1-05)

The Department will pay the Contractor a "Bonus" in the amount of $_____, if the work in the Contract is completed in accordance with 5-11, as determined by the Engineer, on or before _____calendar days from commencement of Contract Time ("Bonus Completion Date") and subject to the conditions precedent set forth below. The term "calendar day" as used in this Article shall mean every day shown on the calendar. Calendar days will be consecutively counted from commencement of Contract Time regardless of weather, weekends, holidays, suspensions of Contractor's operations, delays or other events as described herein. For purposes of the calculation and the determination of entitlement to the "Bonus" stated above, the "Bonus" Completion Date will not be adjusted for any reason, cause or circumstance whatsoever, regardless of fault, save and except in the instance of a catastrophic event (i.e., hurricanes or a declared state of emergency).

The parties anticipate that delays may be caused by or arise from any number of events during the course of the Contract, including, but not limited to, work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of Suppliers, Subcontractors or other Contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of Contractor's operations, or other such events, forces or factors sometimes experienced in highway construction work. Such delays or events and their potential impacts on performance by the Contractor are specifically contemplated and acknowledged by the parties in entering into this Contract, and shall not extend the "Bonus Completion Date" set forth above. Further, any and all costs or impacts whatsoever incurred by the Contractor in accelerating the Contractor's work to overcome or absorb such delays or events in an effort to complete the Contract by the "Bonus Completion Date," regardless of whether the Contractor successfully does so or not, shall be the sole responsibility of the Contractor in every instance.

In the event of a catastrophic event (i.e., hurricane or a declared state of emergency) directly and substantially affecting the Contractor's operations on the Contract, the Contractor and the Department shall agree as to the number of calendar days to extend the "Bonus Completion Date." In the event the Contractor and Department are unable to agree to the number of calendar days to extend the "Bonus Completion Date," the Department shall unilaterally determine the number of calendar days to extend

the "Bonus" Completion Date reasonably necessary and due solely to such catastrophic event and the Contractor shall have no right whatsoever to contest such determination, save and except that the Contractor establishes that the number of calendar days determined by the Department was arbitrary or without any reasonable basis.

However, notwithstanding anything above to the contrary, upon the Contractor's written request being made directly to the Chief Engineer, with copies provided to both the Resident Construction Engineer and the District Construction Engineer, the Department reserves unto the Chief Engineer, in his sole and absolute discretion, according to the parameters set forth below, the authority to make a determination to either fully enforce the above provisions with no modification, modify the "Bonus Completion Date" by moving it, or both modify the "Bonus Completion Date" by moving it and also modify the "Bonus" amount by reducing it.

No modification of a "Bonus" provision will be considered by the Chief Engineer for any impacts whatsoever, beyond the reasonable control of the Contractor, for which the effect results in a time extension of less than 15% of the time remaining in the period from the first day of occurrence of such impact to the "Bonus Completion Date." Furthermore, as to any such impact, for which the effect results in a time extension of 15% or more of the time remaining in the period from the first day of occurrence of such impact to the "Bonus Completion Date," no modification of a "Bonus" provision will be considered by the Chief Engineer unless the contractor clearly establishes that it has continuously from the beginning of the project aggressively, efficiently and effectively pursued the achievement of the "Bonus." This would include the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work so as to still achieve the "Bonus," and that, but for this impact, the Contractor would have otherwise earned the "Bonus" provided in the original Contract. Also, to the extent the request is not submitted in writing to the Chief Engineer within not less than twenty (20) calendar days prior to the original "Bonus Completion Date," the Contractor must also continue to aggressively, efficiently, and effectively pursue the completion of the "Bonus" work. This would include the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work, until a determination is made by the Chief Engineer or twenty (20) calendar days has expired since such written request was received by the Chief Engineer. There shall be no right of any kind on behalf of the Contractor to challenge or otherwise seek review or appeal, in any forum, any determination made by the Chief Engineer under this provision.

The Contractor shall have no rights under the Contract to make any claim arising out of this "Bonus" provision except as is expressly set forth in this Article.

As conditions precedent to the Contractor's entitlement to any "Bonus" the Contractor must:
(1) Deliver in-hand to the Department any and all claims, in full accordance with 5-12.3 and subject to the limitations therein, no later than 60 calendar days after completion of the work on which such claim is based and tentatively schedule a Disputes Review Board hearing while awaiting Department review and response to any such claim. Furthermore, as to any such 5-12.3 claims for which the Disputes Review Board has determined entitlement but both parties have not reached an agreement on monetary compensation prior to final acceptance, and also as to those 5-12.3 claims pending at or submitted after final acceptance, tentatively schedule a Disputes Review Board hearing within 60 calendar days after the final acceptance date while awaiting Department review and response to any such claim. The sole forum for final determination as to both entitlement and amount of monetary compensation, if not otherwise mutually resolved or otherwise agreed, shall be the Disputes Review Board.

(2) Actually complete the Contract and obtain final acceptance by the Department, as determined by the Engineer in accordance with 5-11, on or before the "Bonus Completion Date."

(3) No later than 60 days after final acceptance by the Department, the Contractor must either (a) elect to be paid the "Bonus" pursuant to (4) below, or (b) notify the Department in writing that the Contractor is electing to be paid the "Bonus" and is reserving one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board. The determinations of the Disputes Review Board as to any such 5-12.3 claims will be fully binding on both the Department and the Contractor, with no right of any kind of challenge, review or appeal, in any forum, by either party. Further, under (b) herein, any previous Disputes Review Board determinations on any such 5-12.3 claims issues shall then be fully binding and not subject to reconsideration by the Disputes Review Board, regardless of whether either party has previously rejected or otherwise not accepted one or more such recommendations at the time such were rendered.

(4) The Contractor shall notify the Department in writing, within 60 days of the final acceptance of the work in the Contract by the Department, that the Contractor elects to be paid the "Bonus" which the Contractor is eligible to be paid based on the actual final acceptance date, and such written notice shall constitute a full and complete waiver, release and acknowledgment of satisfaction by the Contractor of any and all claims, causes of action, issues, demands, disputes, matters or controversies, of any nature or kind whatsoever, known or unknown, against the Department, its employees, officers, agents, representatives, consultants, and their respective employees, officers and representatives, the Contractor has or may have as to work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers or subcontractors or other Contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of the Contractor's operations, extended or unabsorbed home office or job site overhead, lump sum maintenance of traffic adjustments, lost profits, prime mark-up on subcontractor work, acceleration costs, any and all direct and indirect costs, any other adverse impacts, events, conditions, circumstances or potential damages, on or pertaining to, or as to or arising out of the Contract. This waiver, release and acknowledgment of satisfaction shall be all-inclusive and absolute, save and except any routine Department final estimating quantity adjustments.

Should the Contractor fail to actually complete the Contract and obtain final acceptance by the Department as determined by the Engineer in accordance with 5-11, on or before the "Bonus Completion Date," or should the Contractor, having done so, fail to timely request the "Bonus" for any reason, and including but not limited to the Contractor choosing not to either reserve one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board as set forth in (3)(b) above, or to fully waive, release and acknowledge satisfaction as set forth in (4) above, the Contractor shall have no right to any payment whatsoever under this Article.

In the event the Contractor elects to exercise the "Bonus Payment" provision, should this provision conflict with any other provision of the Contract, the Contract shall be interpreted in accordance with this provision.

8-13.1 "Bonus" Payment and Waiver of Contractor Claims.
(REV 12-15-03) (FA 1-8-04) (7-04)

The Department desires to expedite construction on this Contract to minimize the inconvenience to the

traveling public and to reduce the time of construction. In order to achieve this, "Bonus" provisions are established for the Contract Work Items described below.

The Department will pay the Contractor a "Bonus" as follows:

Contract Work Item	Bonus Completion Date	Bonus Amount
Usage—describe work and tie to the plans	Alt 1 Calendar days from commencement of Contract Time. Alt 2 Date	(Amount of bonus)
Example: Complete project in accordance with 5-11	Alt 1 Calendar days from commencement of Contract Time. Alt 2 Date	(Amount of bonus)

The "Bonus" will be paid only if the "Contract Work Item" is completed as set forth above, and as determined by the Engineer, on or before the "Bonus Completion Date" as set forth above, and subject to the conditions precedent set forth below. For purposes of the calculation and the determination of entitlement to the "Bonus" stated above, the "Bonus Completion Date" will not be adjusted for any reason, cause or circumstance whatsoever, regardless of fault, save and except in the instance of a catastrophic event (i.e., hurricane or a declared state of emergency).

The parties anticipate that delays may be caused by or arise from any number of events during the course of the Contract, including, but not limited to, work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers, subcontractors or other contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of Contractor's operations, or other such events, forces or factors sometimes experienced in highway construction work. Such delays or events and their potential impacts on performance by the Contractor are specifically contemplated and acknowledged by the parties in entering into this Contract, and shall not extend the "Bonus Completion Date" set forth above. Further, any and all costs or impacts whatsoever incurred by the Contractor in accelerating the Contractor's work to overcome or absorb such delays or events in an effort to complete the Contract by the "Bonus Completion Date," regardless of whether the Contractor successfully does so or not, shall be the sole responsibility of the Contractor in every instance.

In the event of a catastrophic event (i.e., hurricane or a declared state of emergency) directly and substantially affecting the Contractor's operations on the Contract, the Contractor and the Department shall agree as to the number of calendar days to extend the "Bonus Completion Date." In the event the Contractor and Department are unable to agree to the number of calendar days to extend the "Bonus Completion Date," the Department shall unilaterally determine the number of calendar days to extend the "Bonus Completion Date" reasonably necessary and due solely to such catastrophic event and the Contractor shall have no right whatsoever to contest such determination, save and except that the

Contractor establishes that the number of calendar days determined by the Department was arbitrary or without any reasonable basis.

However, notwithstanding anything above to the contrary, upon the Contractor's written request being made directly to the Chief Engineer, with copies provided to both the Resident Construction Engineer and the District Construction Engineer, the Department reserves unto the Chief Engineer, in his sole and absolute discretion, according to the parameters set forth below, the authority to make a determination to either fully enforce the above provisions with no modification, modify the "Bonus Completion Date" by moving it, or both modifying the "Bonus Completion Date" by moving it and also modify the "Bonus" amount by reducing it.

No modification of a "Bonus" provision will be considered by the Chief Engineer for any impacts whatsoever, beyond the reasonable control of the Contractor, for which the effect results in a time extension of less that 15% of the time remaining in the period from the first day of occurrence of such impact to the "Bonus Completion Date," Furthermore, as to any such impact, for which the effect results in a time extension of 15% or more of the time remaining in the period from the first day of occurrence of such impact to the "Bonus Completion Date," no modification of a "Bonus" provision will be considered by the Chief Engineer unless the contractor clearly establishes that it has continuously from the beginning of the project aggressively, efficiently and effectively pursued the achievement of the "Bonus." This would include the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work so as to still achieve the "Bonus," and, but for this impact, the Contractor would have otherwise earned the "Bonus" provided in the original Contract. Also, to the extent the request is not submitted in writing to the Chief Engineer within not less than twenty (20) calendar days prior to the original "Bonus Completion Date," the Contractor must also continue to aggressively, efficiently, and effectively pursue the completion of the "Bonus" work. This would include the utilization of any and all reasonably available means and methods to overcome all impacts and accelerate the work, until a determination is made by the Chief Engineer or twenty (20) calendar days has expired since such written notice. There shall be no right of any kind on behalf of the Contractor to challenge or otherwise seek review or appeal, in any forum, of any determination made by the Chief Engineer under this provision.

The Contractor shall have no rights under the Contract to make any claim arising out of this "Bonus" provision except as is expressly set forth in this Article.

As conditions precedent to the Contractor's entitlement to any "Bonus" the Contractor must:
(1) Deliver in-hand to the Department any and all claims in full accordance with 5-12.3 and subject to the limitations therein, no later than 60 calendar days after completion of the work on which such claim is based and tentatively schedule a Disputes Review Board hearing while awaiting Department review and response to any such claim. Furthermore, as to any such 5-12.3 claims for which the Disputes Review Board has determined entitlement but both parties have not reached an agreement on monetary compensation prior to final acceptance, and also as to those 5-12.3 claims pending at or submitted after "Bonus Date," tentatively schedule a Disputes Review Board hearing within 60 calendar days after the final acceptance date while awaiting Department review and response to any such claim. The sole forum for final determination as to both entitlement and amount of monetary compensation, if not otherwise mutually resolved, or otherwise agreed, shall be the Disputes Review Board.

(2) Actually complete the "Contract Work Item" and obtain written verification of completion from the Engineer on or before the "Bonus Completion Date."

(3) No later than 60 days after "Bonus Date" by the Department, the Contractor must either (a) elect to be paid the "Bonus" pursuant to (4) below, or (b) notify the Department in writing that the Contractor is electing to be paid the "Bonus" and is reserving one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board. The determinations of the Disputes Review Board as to any such 5-12.3 claims will be fully binding on both the Department and the Contractor, with no right of any kind of challenge, review or appeal, in any forum, by either party. Further, under (b) herein, any previous Disputes Review Board determinations on any such 5-12.3 claims issues shall then be fully binding and not subject to reconsideration by the Disputes Review Board, regardless of whether either party has previously rejected or otherwise not accepted one or more such recommendations at the time such were rendered.

(4) The Contractor shall notify the Department in writing, within 60 days of receiving written verification of completion of the "Contract Work Item" by the Engineer per (2) above, that the Contractor elects to be paid the "Bonus" which the Contractor is eligible to be paid based on the actual "Bonus Completion Date," and such written notice shall constitute a full and complete waiver, release and acknowledgment of satisfaction by the Contractor of any and all claims, causes of action, issues, demands, disputes, matters or controversies, of any nature or kind whatsoever, known or unknown, against the Department, its employees, officers, agents, representatives, consultants, and their respective employees, officers and representatives, the Contractor has or may have as to work performed, work deleted, change orders, supplemental agreements, delays, disruptions, differing site conditions, utility conflicts, design changes or defects, time extensions, extra work, right of way issues, permitting issues, actions of suppliers or subcontractors or other contractors, actions by third parties, shop drawing approval process delays, expansion of the physical limits of the project to make it functional, weather, weekends, holidays, suspensions of the Contractor's operations, extended or unabsorbed home office or job site overhead, lump sum maintenance of traffic adjustments, lost profits, prime mark-up on subcontractor work, acceleration costs, any and all direct and indirect costs, any other adverse impacts, events, conditions, circumstances or potential damages, on or pertaining to, or as to or arising out of the Contract. This waiver, release and acknowledgment of satisfaction shall be all-inclusive and absolute, save and except any routine Department final estimating quantity adjustments.

Should the Contractor fail to actually complete the "Contract Work Item" and obtain written verification of completion of the "Contract Work Item" from the Engineer on or before the "Bonus Completion Date," or should the Contractor, having done so, fail to timely request the "Bonus" for any reason, and including but not limited to the Contractor choosing not to either reserve one or more outstanding 5-12.3 claims for final and fully binding determination by the Disputes Review Board as set forth in (3)(b) above, or to fully waive, release and acknowledge satisfaction as set forth in (4) above, the Contractor shall have no right to any payment whatsoever under this Article.

In the event the Contractor elects to exercise the "Bonus Payment" provision, should this provision conflict with any other provision of the Contract, the Contract shall be interpreted in accordance with this provision.

As to any Contract Work Item provided for herein, the Contractor will remain responsible for all such work and the continued maintenance thereof until such date as the Department final accepts all Work under the Contract in accordance with 5-11, and without regard to whether the Department has provided written verification of completion or not, and without regard to whether any "Bonus" was earned or elected hereunder.

Appendix J

Example Specifications for Lane Rental

FDOT Specifications

8-13.1 Incentive-Disincentive for Lane Rental Days.
(REV 9-25-03) (FA 12-24-03) (7-04)

The Department desires to minimize the inconvenience to the traveling public by reducing the amount of time during which the Contractor closes one or more lanes as permitted by the Contract. In order to achieve this, an incentive-disincentive provision for Lane Rental Days is established for the Contract. The total incentive payment or disincentive deduction shall not exceed $_____.

For the purposes of this Subarticle, the following definition will apply:
Lane Rental Day: The time period during which the Contractor closes one or more lanes as permitted by the Contract. The Engineer will not consider lane closures for time periods less than 15 minutes in computing Lane Rental Days. The computation of Lane Rental Days will include moving operations. The number of lanes considered closed will be based on the number of lanes available prior to construction versus the number of lanes maintained through the project during any particular day. A lane is a mainline through lane or ramp. Lane Rental Days will be computed in full day and half day increments. A full day will be computed for any lane closure(s) or any combination of lane closures totaling over 12 hours in cumulative length over a 24 hour period. For purposes of computing Lane Rental Days, the 24 hour period will be continuous and will begin when the Contractor begins the closure. Computation of Lane Rental Days will continue until the detour is completely removed and traffic is restored. A half-day will be computed for any lane closure(s) or any combination of lane closures totaling 12 hours or less cumulative in length within a 24 hour period.

The total allowable number of Lane Rental Days established for this contract is _____. The Engineer, at his sole discretion, will determine the total number of Lane Rental Days used by the Contractor by making a summation of all full day and half day increments.

If the Contractor uses fewer Lane Rental Days than the total allowable number of Lane Rental Days, the Department will pay the Contractor an incentive payment in the amount of $_____ for every Lane Rental Day less than the total allowable number of Lane Rental Days established for this Contract. If the Contractor uses more Lane Rental Days than the total allowable number of Lane Rental Days, the Department will make a disincentive deduction in the amount of $_____ for every Lane Rental Day more than the allowable number of Lane Rental Days established for this Contract, from funds otherwise due the Contractor.

Notwithstanding any incentive payments or any disincentive deductions related to the total allowable number of Lane Rental Days, a damage recovery/user cost will be assessed against the Contractor if all lanes are not open to traffic during the time periods identified in the Traffic Control Plans. Costs will be assessed beginning at applicable times indicated in the Traffic Control Plans and continue until all lanes are open as recorded by the Engineer. This assessment will be in the following amounts:

First 30 minutes and under: $_____
Each additional 30 minute period or portion thereof: $_____

Such damage recovery/user costs will not exceed $_____ over a 24 hour period.

At the sole discretion of the Engineer, damage recovery/user costs will not be assessed for failure to open traffic lanes if such cause is beyond the control of the Contractor, i.e., catastrophic events, accidents not related or caused by the Contractor's operations.

The Department will have the right to apply as payment on such damages any money which is due to the Contractor by the Department.

AWARD AND EXECUTION OF CONTRACT.
(REV 4-11-97) (FA 5-7-97) (7-00)

ARTICLE 3-1 (Pages 14 and 15). The first and second sentences are deleted and the following substituted:

For the purpose of award, each bid submitted shall consist of two parts whereby:

Standard Bid (A) = The correct summation of the products of the estimated quantities shown in the proposal, multiplied by their bid unit prices.

Time Bid (B) = [LRD times the Daily Lane Rental Fee] = the product of the number of Lane Rental Days (LRD) provided by the Contractor and the Daily Lane Rental Fee established by the Department.

The lowest evaluated bid (Total Bid) will be determined by the Department as the lowest sum of (A) plus (B) according to the following formula:

Total Bid = Standard Bid (A) + Time Bid (B)

The preceding formula will not be used to determine final payment to the Contractor. All payments will be based on quantities and bid unit prices.

The DBE utilization goals and bonding requirements will be applied to the Standard Bid ("A" portion) only.

PREPARATION OF PROPOSALS.
(REV 2-21-05) (FA 3-31-05) (1-06)

SUBARTICLE 2-5.1 (of the Supplemental Specifications) is expanded by the following:

Determine the number of Lane Rental Days (LRD) required to perform the work specified and show this number in the proposal.

The following definitions will apply:

Lane Rental Day: The time period during which the Contractor closes one or more lanes as permitted by the Contract. The Engineer will not consider time periods less than 15 minutes in computing Lane Rental Days. The computation of Lane Rental Days will include moving operations. The number of lanes considered closed will be based on the number of lanes available prior to construction versus the number of lanes maintained through the project during any particular day. A lane is a mainline through lane or ramp.

Lane Rental Days will be computed in full day and half-day increments. A full day will be computed for any lane closure(s) or any combination of lane closures totaling over 12 hours in cumulative length over a 24 hour period. For purposes of computing Lane Rental Days, the 24 hour period will be continuous and will begin when the Contractor begins the closure. Computation of Lane Rental Days will continue until the closure is completely removed. A half-day will be computed for any lane closure(s) or any combination of lane closures totaling 12 hours or less cumulative in length within a 24 hour period. Lane

Rental Days will be charged for each calendar day without regard to whether Contract time is charged.

Daily Lane Rental Fee: The full day Daily Lane Rental Fee is $_____ per lane per day. The half day Daily Lane Rental Fee is 50% of the full day Daily Lane Rental Fee. The lane rental items will only be shown on the lead project on Contracts with multiple projects, but will cover work for all projects within the Contract.

8-13.1 Pay Adjustment For Fewer-More Lane Rental Days.
(REV 4-29-97) (FA 5-7-97) (7-00)

If the Contractor uses more Lane Rental Days than what was specified in the proposal, the Department will assess a per day fee equal to the Daily Lane Rental Fee. If the Contractor uses fewer Lane Rental Days than what was specified in the proposal, the Department will pay a per day incentive equal to the Daily Lane Rental Fee.

Appendix K

Example Specification for Value Engineering

RIDOT Specification

SECTION 104.99
VALUE ENGINEERING

PURPOSE: The Contractor may submit to the Department value-engineering (VE) proposals that change the Contract Documents resulting in Construction Cost Savings and Time Savings. The Department will share with the Contractor any cost savings that result from an approved VE proposal.

GENERAL REQUIREMENTS: The VE proposal must conform to the latest Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction and Rhode Island Standard Details and environmental permit regulations and requirements.

The VE proposal must maintain the essential functions and characteristics of the facility including but not limited to safety, service life, ease of maintenance, and appearance.

The Contractor's Conceptual VE proposal will be reviewed by the Department, and if approved, the Contractor shall submit a formal VE proposal including revised drawings prepared and stamped by a Rhode Island licensed Professional Engineer, specifications, distribution of quantities and cost savings, which reflect the work required to complete the VE proposal.

CONDITIONS: The Department will be the sole judge of the VE proposal in determining the following:
1. Approval or Disapproval
2. Construction Cost Savings
3. Time Savings
4. Advantages andlor Disadvantages

The Department reserves the right to disregard the contract unit bid prices if, in the judgment of the Engineer, such prices do not represent fair value for the work to be performed or deleted. The Engineer will adjust the contract unit bid prices in evaluating the Construction Cost Savings of the VE proposal. If the Department approves the VE proposal, the Department will order changes to the Contract Documents that reflect the VE proposal in accordance with the appropriate subsections of Section 104 of the Rhode Island Standard Specifications for Road and Bridge Construction, 1997 Edition and all applicable compilations of approved specifications.

MEASUREMENT AND PAYMENT: If the Department approves the VE proposal, the Department will provide measurements and payments in accordance with the appropriate subsections of Section 109 of the Rhode Island Standard Specifications for Road and Bridge Construction, 1997 Edition and all applicable compilations of approved specifications.

The Department and the Contract or shall equally share the Construction Cost Savings amount resulting the VE proposal. The Contractor shall receive 25 percent of the Contractor's share when the VE proposal

is approved. The Contractor shall receive 75 percent of the Contractor's share when the Engineer has accepted the work related to the VE proposal.

The Department will not reimburse the Contractor for any engineering or preparation expenditures of the VE proposal.

Appendix L

Examples of Partnering Provisions

FDOT Graves Avenue/I-4 Project

PROSECUTION OF WORK—PARTNERING.
(REV 3-4-98) (FA 5-26-98) (7-00)

ARTICLE 8-3 (Pages 73-75) is expanded by the following new Subarticle:

8-3.6 Partnering: For this Contract, a non-bid pay item in the Lump Sum amount of **$24,000** has been established for Partnering. The objective of Partnering is to establish a partnership charter and action plan for the Contractor, the Engineer and other parties impacted by the activities covered under this contract to identify and achieve reciprocal goals. These objectives may be met through participation in a major workshop held as early as possible after the Contract is awarded and follow-up workshops held periodically throughout the duration of the Contract.

As early as possible and prior to the preconstruction conference, meet with the Department's District Construction Engineer and plan an initial partnering/team building workshop. At this planning session, select a workshop facilitator, suitable to the District Construction Engineer, from the Department-approved list of facilitators maintained by the Quality Initiatives Office. Additionally, the agenda, duration, location, time, and attendees for the initial workshop should be determined. Attendees should include the Department's District Construction Engineer and key project personnel, the Contractor's Superintendent and key personnel as well as other project or field-level personnel.

Partnering workshops may be held periodically throughout the duration of the Contract if authorized by the District Construction Engineer.

The Department will reimburse the Contractor based on actual invoice amounts for the following costs associated with Partnering:

a. Meeting room.
b. Facilitator fees.
c. Travel expenses of the facilitator, in accordance with Section 112.061, Florida Statutes.

The Department will not reimburse the Contractor for any other expenses. Payment will be the actual cost prorated as a percent of the Lump Sum amount. Payment shall be made under:

Item No. 999-16-Partnering-lump sum.
Item No. 2999-16-Partnering-lump sum.

NYSDOT Standard Specification for Partnering

ITEM 15637.98 M—PARTNERING WORKSHOP

DESCRIPTION: Standard Specification Section 103-02A - PARTNERING, contains the Department's policy to implement partnering concepts and principles on construction contracts. Project partnering will be categorized as "formal" and "informal" partnering. This item relates to formal partnering only.

The Department is offering to progress this contract with formal partnering. Should the Contractor voluntarily accept the Department's offer and agree to partner this contract, then this item will be utilized.
Under this item, the Contractor will provide the services of an independent Facilitator to coordinate and facilitate an initial partnering workshop for this contract. In the spirit of partnership, the State and the Contractor will equally share the cost of the partnering workshop. The Contractor is responsible for initially paying the entire cost of the Facilitator and the associated workshop costs. The intent of this item is to reimburse the Contractor 50 percent of those costs.

MATERIALS: None Specified.

CONSTRUCTION DETAILS: The Contractor and the Regional Construction Engineer will jointly select a Facilitator and a location for the workshop. A list of potential Facilitators is available from the Department. The Facilitator shall present a 1 to 2 day Partnering Workshop for this project between the time of award and the start of the project. For long-duration, multiyear projects, a subsequent follow-up workshop may be convened, with the agreement of the Contractor and the Regional Construction Engineer, at an appropriate point during the progression of the project. The associated costs for this subsequent workshop will be reimbursed under this item.

METHOD OF MEASUREMENT: Payment for costs incurred will be computed by Force Account for 50 percent of the actual and reasonable receipted costs of completing this item in accordance with Section 109-05 of the Standard Specifications. Receipted costs eligible for 50% reimbursement under this item shall include the fee for the Facilitator and the costs for the Facilitator's travel and expenses; associated workshop costs, such as charges for the rental of the meeting room, required audio/visual equipment,
and any handouts, notes or workshop materials.

The costs for travel, lodging, meals and salaries of workshop attendees, other than those of the facilitator, will not be eligible for full or partial reimbursement under this item.

BASIS OF PAYMENT: The fixed price lump sum shown in the itemized proposal for this work will be considered the price bid even though payment will be made only for 50 percent of the actual cost of the Facilitator and associated workshop costs.

The fixed price lump sum for this item is believed to be sufficiently large enough to include 50% of the eligible receipted partnering workshop costs. Should the amount of the fixed price lump sum not be sufficient, the State will supplement it as necessary through the order-on-contract process as approved by the Engineer.

The fixed price lump sum figure is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figure will be disregarded, and the original price will be used to determine the total amount bid for the contract.

L9/9/99 4/1/99
EI 99-004

A. Partnering. It is the Department's policy to use the principles of partnering to guide the management of construction contracts and the construction program, within the parameters covered by the laws, regulations and other policies that govern work in the public sector.

The partnering principles are intended to promote quality through continuous improvement at all stages of construction. The goal of the Department is to complete each project in the most efficient, timely, safe, and cost-effective manner, to the mutual benefit of the Contractor and the Department, meaning a quality project delivered on time, within budget, and without significant disputes.

Partnering is defined as those actions taken to include all parties with an appropriate and vested interest in a transportation project in the management of the project such that the project is completed in the most efficient, timely, safe, and cost-effective manner for the mutual benefit of all concerned. Those actions include, but are not limited to, communication, organization, establishing goals, continuous improvement, problem identification, conflict resolution, and managing change. Interested parties may include, but are not limited to, the Department, the contractor, subcontractors, suppliers of goods and services to the project, the community within which the project is constructed, the community served by the project, federal, state and local government or other public agencies, and utilities.

None of the actions identified as part of, or taken in the course of partnering shall be construed to alter, modify, delete or waive any of the provisions or requirements of the Department's Standard Specifications or any applicable laws or regulations.

The Department with the Contractor will manage each contract in a cooperative manner utilizing the following principles of project partnering:
- establish communications with all involved parties early in the partnering process;
- establish a relationship of shared trust, equity, and commitment;
- develop strategies for identifying mutual goals;
- develop strategies for timely communications and decision making;
- establish process for timely response to changes or variations in field conditions;
- solve potential problems, at the lowest level, before they negatively impact the project;
- encourage the use of products, technology and processes that provide a demonstrated level of improved quality; and
- develop a plan for periodic joint evaluation based on mutually agreed-on goals.

The specifications are to be implemented in an equitable fashion that recognizes the problems that are inherent in construction, addresses the different-than-expected field condition, resolves disputes in an open communications manner, and makes contract adjustments in a timely, and fair manner consistent with the terms of the contract. These specifications are intended to fairly allocate risk, resulting in a balanced contractual approach to risk-sharing. The Department will provide information relevant to preparation of a bid for the contract, and in connection with submission of its bid, the Contractor has the right to rely on information provided by the Department in the contract documents.

Appendix M
Example Plan Sheets for Traffic Control Plans

FDOT Graves Avenue/I-4 Project

Traffic Control General Notes

1. The Contractor shall not work over an open traffic lane while placing or removing **bridge spans,** beams, deck forms, or overhead sign structures. The Contractor shall also not pour decks over an open traffic lane.

2. The Contractor shall maintain the same number of lanes that exists prior to beginning construction. The only exceptions are as shown or noted on the plan sheets.

3. Temporary travel lanes shall be no less than 12 feet (3.6 meters) wide except as noted.

4. Peak hours have been established as shown below. The Contractor shall submit requests for lane closures two weeks in advance. The following lane closure restrictions are:
   a. *Insert Roadway Name:* No lane closures will be allowed between the hours of 6:00 A.M. and 9:00 P.M.
   b. *Insert Roadway Name:* No lane closures will be allowed between the hours of 5:00 A.M. and 9:00 P.M.

   Rolling Roadblocks: Rolling roadblocks will be allowed only during the approved lane closure hours.

   Detours and Roadway Closures: Detours and Roadway Closures shall only be used between the hours of 12:00 A.M. and 4:00 A.M. Detours and Roadway Closures shall only be allowed for beam setting ***(or SPMT Span Moves),*** unless otherwise noted in the contract documents.

   Detours, Lane Closures, and Roadway Closures: Listed below are dates when detours, lane closures, and roadway closures are not allowed.

   List Holidays and/or Special Events.

5. The Contractor shall provide a two-week advance notification to all of the following agencies prior to implementing a detour of traffic:
   a. City and county law enforcement agencies
   b. Local fire department
   c. Public transportation agencies
   d. Local school officials
   e. Owner public information office

GENERAL NOTES

1. THE REMOVAL OF THE EXISTING BEAMS AND ERECTION OF THE PROPOSED BEAMS AT THE GRAVES AVE OVERPASS WILL REQUIRE PACING. THE PACING OPERATION SHALL BE RESTRICED FROM 12:00 AM (MIDNIGHT) TO 4 AM.

2. A TOTAL OF FIVE (5) UNIFORMED TRAFFIC CONTROL OFFICERS FOR I-4 WILL BE UTILIZED. EACH WITH FULLY MARKED LAW ENFORCEMENT VEHICLES WITH ROOF-MOUNTED FLASHING LIGHTS WILL BE REQUIRED FOR THE PACING OPERATION ON I-4. THE LOCATION AND NUMBER OF TRAFFIC CONTROL OFFICERS AT EACH LOCATION WILL BE AS FOLLOWS:

3. A TRAFFIC CONTROL SUPERVISOR WILL BE STATIONED AT THE GRAVES AVENUE CONSTRUCTION SITE CONTINUOUSLY THROUGHOUT THE PACING OPERATION TO PROVIDE RADIO COMMUNICATIONS BETWEEN THE CONTRACTOR AND/OR THE ENGINEER, THE LAW ENFORCEMENT VEHICLES AT THE UPSTREAM INTERCHANGE ENTRANCE RAMPS, AND THE THREE (3) LAW ENFORCEMENT VEHICLES COMPRISING THE PACE VEHICLES.

4. PRIOR TO REQUESTING THAT THE TRAFFIC CONTROL SUPERVISOR INITIATE THE PACING OPERATION, THE CONTRACTOR SHALL ENSURE THAT THE NECESSARY CRANE(S) ARE PROPERLY POSITIONED FOR REMOVING AN EXISTING BEAM OR PLACING A PROPOSED BEAM AND THAT THE BEAM IS READY FOR LIFTING (E.G. CABLES FROM CRANE ATTACHED TO BEAM ETC.) IMMEDIATELY AFTER ALL VEHICLES AHEAD OF THE PACE VEHICLES HAVE CLEARED THE WORK AREA. THE CONTRACTOR SHALL THEN REQUEST THAT THE TRAFFIC CONTROL SUPERVISOR INITIATE THE PACING OPERATION.

5. UPON NOTIFICATION BY THE ON-SITE TRAFFIC CONTROL SUPERVISOR, THREE (3) LAW ENFORCEMENT VEHICLES WILL ENTER I-4 AT THE DESIGNATED START POINT AT THE POSTED SPEED LIMIT. TWO (2) OF THE LAW ENFORCEMENT VEHICLES WITH BLUE LIGHTS FLASHING WILL IMMEDIATELY FORM A SIDE-BY-SIDE "ROLLING ROADBLOCK" OF ALL LANES BEHIND THE THIRD LAW ENFORCEMENT VEHICLE (BLUE LIGHTS NOT FLASHING). THE TWO (2) LAW ENFORCEMENT VEHICLES FORMING THE PACE VEHICLES WILL THEN GRADUALLY SLOW I-4 TRAFFIC DOWN TO AN OPERATING SPEED OF 20 MPH AND PACE THE VEHICLES AT THIS SPEED ALL THE WAY TO THE WORK ZONE FOR THE BRIDGE CONSTRUCTION. THE THIRD LAW ENFORCEMENT VEHICLE (WITHOUT BLUE LIGHTS FLASHING) WILL MATCH THE SPEED OF THE LAST VEHICLES AHEAD OF THE PACE VEHICLES AND TRAIL THE LAST VEHICLES TOWARD THE WORK ZONE UNTIL A POINT 500 FEET IN ADVANCE OF THE WORK ZONE. AT THIS POINT 500 FEET FROM THE WORK ZONE, THE THIRD LAW ENFORCEMENT VEHICLE WILL ACTIVATE ITS FLASHING BLUE LIGHTS AND COME TO A COMPLETE STOP, POSITIONING THE VEHICLE TO BLOCK OFF ALL LANES OF I-4. IN CASE OF EMERGENCY, THE PACE VEHICLES WILL COME TO A COMPLETE STOP AT THIS POINT. OTHERWISE, THE THIRD LAW ENFORCEMENT VEHICLE WILL CLEAR THE ROADWAY WHEN THE "ROLLING ROADBLOCK" APPROACHES THE WORK ZONE.

6. WHEN NOTIFIED, BY RADIO, BY THE ON-SITE TRAFFIC CONTROL SUPERVISOR OF THE START OF THE PACING OPERATION, THE TRAFFIC CONTROL OFFICERS STATIONED AT EACH OF THE UPSTREAM ENTRANCE RAMPS TO I-4 WILL ACTIVATE THEIR VEHICLES' FLASHING BLUE LIGHTS AND POSITION THEIR VEHICLES ACROSS THE RAMP TO BLOCK ACCESS TO I-4. RAMP TRAFFIC WILL BE DETAINED TEMPORARILY FROM THAT TIME UNTIL THE ROADBLOCK PASSES. ONCE THE PACE VEHICLES PASS THE ENTRANCE RAMP, THE TRAFFIC CONTROL OFFICERS WILL REMOVE THEIR VEHICLES FROM THE RAMPS, DEACTIVATE THE FLASHING BLUE LIGHTS, AND ALLOW THE TRAFFIC TO ENTER I-4 AND FOLLOW THE PACE VEHICLES.

7. ONCE THE LEAD LAW ENFORCEMENT VEHICLE IN ADVANCE OF THE PACE VEHICLES HAS COME TO A STOP AND BLOCKED OFF THE I-4 LANES 500 FEET IN ADVANCE OF THE WORK ZONE, THE CONTRACTOR SHALL LIFT THE BEAM INTO POSITION. EACH PACING OPERATION CYCLE WILL CREATE A 20 MINUTE TIME SPAN DURING WHICH THE CONTRACTOR SHALL SET ONE BEAM. THE TWO (2) LAW ENFORCEMENT VEHICLES FORMING THE PACE VEHICLES SHALL NOTIFY THE TRAFFIC CONTROL SUPERVISOR WHEN THEY REACH A POINT WITHIN ONE MILE OF THE BRIDGE SITE. THE TRAFFIC CONTROL SUPERVISOR WILL, IN TURN, NOTIFY THE CONTRACTOR OF THE APPROACHING PACE VEHICLES, AT WHICH TIME THE CONTRACTOR SHALL BEGIN TO CLEAR EQUIPMENT AND WORKERS (BOTH ON THE GROUND AND OVERHEAD) FROM THE LANES OF I-4 TO PREPARE FOR RE-OPENING TRAFFIC. IF THE BEAM IS NOT ADEQUATELY SECURED AT THIS TIME, THE CRANE SHALL REMAIN ATTACHED TO THE BEAM TO PROVIDE ADDITIONAL SUPPORT, AND A SUBSEQUENT PACING OPERATION SHALL BE USED TO DISCONNECT THE CRANE FROM THE BEAM. IF THE ROADWAY HAS BEEN CLEARED PRIOR TO THE ARRIVAL OF THE PACE VEHICLES, THE CONTRACTOR SHALL NOTIFY THE TRAFFIC CONTROL SUPERVISOR. THE TRAFFIC CONTROL SUPERVISOR WILL THEN NOTIFY ALL OF THE OTHER LAW ENFORCEMENT VEHICLES TO DISCONTINUE THE PACING OPERATION AND THE ENTRANCE RAMP ROADBLOCKS.

8. THE CONTRACTOR SHALL WAIT A MINIMUM OF 30 MINUTES FROM THE TERMINATION OF ONE PACING OPERATION TO THE COMMENCEMENT OF THE NEXT TO PERMIT I-4 TRAFFIC TO RETURN TO NORMAL SPEEDS AND FLOW AS DETERMINED BY THE ENGINEER, AND TO ALLOW THE THREE (3) LAW ENFORCEMENT VEHICLES COMPRISING THE PACE VEHICLES TO RETURN TO THE DESIGNATED START POINT.

9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE TIMELY CORRECTION OF CONSTRUCTION DAMAGES TO I-4.

10. THE CONTRACTOR SHALL STORE ANY MATERIAL IN THE VICINITY OF I-4 EITHER OUTSIDE OF THE CLEAR ZONE OR BEHIND CONCRETE BARRIERS.

11. VARIABLE MESSAGE SIGNS ARE REQUIRED TO BE PROGRAMMABLE BY CELLULAR PHONE.

12. THE VARIABLE MESSAGE SIGNS ON I-4 ARE TO BE LOCATED 1000' PRIOR TO THE GRAVES AVENUE BRIDGE. THE VARIABLE MESSAGE SIGN ON THE ENTRANCE RAMP IS TO BE LOCATED ON THE RAMP, 100' FROM THE INTERSECTING SIDE STREET.

C. Brian Fuller
6/30/04

UNIFORMED TRAFFIC CONTROL OFFICER COUNT, FUNCTION, AND LOCATION FOR I-4 PACING OPERATION

NUMBER OF TRAFFIC CONTROL OFFICERS WITH LAW ENFORCEMENT VEHICLES	FUNCTION	LOCATION
1	SUPERVISOR	GRAVES AVE
3	ROLLING ROADBLOCK	MOBILE OPERATION STARTING PRIOR TO THE DIRKSON DR. OR SR 44 INTERCHANGE AND ENDING AT GRAVES AVENUE
2 (EASTBOUND PACING) 3 (WESTBOUND PACING)	ENTRANCE RAMP ROADBLOCKS	EASTBOUND PACING - ENTRANCE RAMPS @ DIRKSON DR. AND SAXON BLVD. WESTBOUND PACING - ENTRANCE RAMPS @ SR 44, ORANGE CAMP ROAD, AND SR 472.

NOTE:
DIRKSON DR. IS LOCATED 5.53 MILES WEST, ORANGE CAMP ROAD IS LOCATED 2.57 MILES EAST, AND SR 44 IS LOCATED 5.13 MILES EAST OF GRAVES AVE.

I-4 VMS DISPLAYS

FOR ONE WEEK PRIOR TO ROLLING ROADBLOCK	BRIDGE WORK ON I-4	10/21 TO 10/23 12AM - 4AM
THE DAY OF THE PACING OPERATION	BRIDGE WORK TONIGHT	12AM - 4AM 20 MIN. DELAYS
DURING THE PACING OPERATION	PACE CARS AHEAD	SLOW MOVING TRAFFIC

ENTRANCE RAMPS VMS DISPLAYS

FOR ONE WEEK PRIOR TO PACING OPERATION	BRIDGE WORK ON I-4	10/21 TO 10/23 12AM - 4AM
THE DAY OF THE PACING OPERATION	BRIDGE WORK TONIGHT	12AM - 4AM 20 MIN. DELAYS
DURING THE PACING OPERATION	PACE CARS ON I-4	EXPECT TO STOP AHEAD

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

• ENGINEERS
• PLANNERS
• SURVEYORS

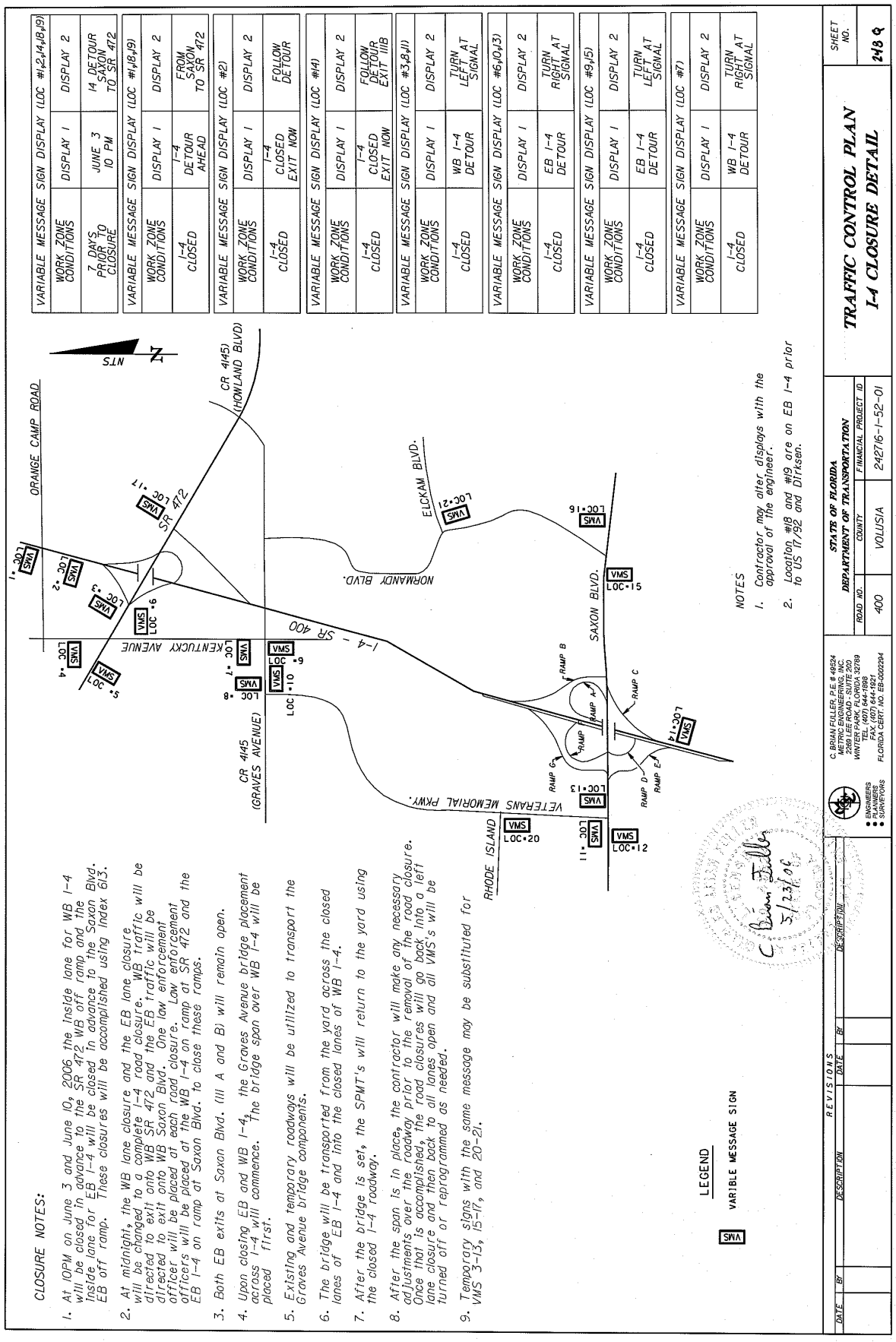
C. BRIAN FULLER, P.E. # 49524
METRIC ENGINEERING, INC.
2269 LEE ROAD - SUITE 200
WINTER PARK, FLORIDA 32789
TEL. (407) 644-1898
FAX. (407) 644-1921
FLORIDA CERT. NO. EB-0002294

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
400	VOLUSIA	242716-1-52-01

TRAFFIC CONTROL PLAN
I-4 PACING OPERATION
GENERAL NOTES

SHEET NO. 247


CLOSURE NOTES:
1. At 10PM on June 3 and June 10, 2006 the inside lane for WB I-4 will be closed in advance to the SR 472 WB off ramp and the inside lane for EB I-4 will be closed in advance to the Saxon Blvd. EB off ramp. These closures will be accomplished using Index 613.
2. At midnight, the WB lane closure and the EB lane closure will be changed to a complete I-4 road closure. WB traffic will be directed to exit onto WB SR 472 and the EB traffic will be directed to exit onto WB Saxon Blvd. One law enforcement officer will be placed at each road closure. Law enforcement officers will be placed at the WB I-4 on ramp at SR 472 and the EB I-4 on ramp at Saxon Blvd. to close these ramps.
3. Both EB exits at Saxon Blvd. (ill A and B) will remain open.
4. Upon closing EB and WB I-4, the Graves Avenue bridge placement across I-4 will commence. The bridge span over WB I-4 will be placed first.
5. Existing and temporary roadways will be utilized to transport the Graves Avenue bridge components.
6. The bridge will be transported from the yard across the closed lanes of EB I-4 and into the closed lanes of WB I-4.
7. After the bridge is set, the SPMT's will return to the yard using the closed I-4 roadway.
8. After the span is in place, the contractor will make any necessary adjustments over the roadway prior to the removal of the road closure. Once that is accomplished, the road closures will go back into a left lane closure and then back to all lanes open and all VMS's will be turned off or reprogrammed as needed.
9. Temporary signs with the same message may be substituted for VMS 3-13, 15-17, and 20-21.
LEGEND
VMS
VARIBLE MESSAGE SIGN
NOTES
1. Contractor may alter displays with the approval of the engineer.
2. Location #18 and #19 are on EB I-4 prior to US 17/92 and Dirksen.
VARIABLE MESSAGE SIGN DISPLAY (LOC #1,#2,#4,#18,#19)
WORK ZONE CONDITIONS | DISPLAY 1 | DISPLAY 2
7 DAYS PRIOR TO CLOSURE | JUNE 3 10 PM | I4 DETOUR SAXON TO SR 472
I-4 CLOSED | DETOUR AHEAD | FROM SAXON TO SR 472
VARIABLE MESSAGE SIGN DISPLAY (LOC #1,#8,#9)
WORK ZONE CONDITIONS | DISPLAY 1 | DISPLAY 2
I-4 CLOSED | DETOUR AHEAD | FROM SAXON TO SR 472
VARIABLE MESSAGE SIGN DISPLAY (LOC #2)
WORK ZONE CONDITIONS | DISPLAY 1 | DISPLAY 2
I-4 CLOSED | CLOSED EXIT NOW | FOLLOW DETOUR
VARIABLE MESSAGE SIGN DISPLAY (LOC #14)
WORK ZONE CONDITIONS | DISPLAY 1 | DISPLAY 2
I-4 CLOSED | CLOSED EXIT NOW | FOLLOW DETOUR EXIT 111B
VARIABLE MESSAGE SIGN DISPLAY (LOC #3,#4,#11)
WORK ZONE CONDITIONS | DISPLAY 1 | DISPLAY 2
I-4 CLOSED | WB I-4 DETOUR | TURN LEFT AT SIGNAL
VARIABLE MESSAGE SIGN DISPLAY (LOC #6,#10,#13)
WORK ZONE CONDITIONS | DISPLAY 1 | DISPLAY 2
I-4 CLOSED | EB I-4 DETOUR | TURN RIGHT AT SIGNAL
VARIABLE MESSAGE SIGN DISPLAY (LOC #9,#15)
WORK ZONE CONDITIONS | DISPLAY 1 | DISPLAY 2
I-4 CLOSED | EB I-4 DETOUR | TURN LEFT AT SIGNAL
VARIABLE MESSAGE SIGN DISPLAY (LOC #7)
WORK ZONE CONDITIONS | DISPLAY 1 | DISPLAY 2
I-4 CLOSED | WB I-4 DETOUR | TURN RIGHT AT SIGNAL
ORANGE CAMP ROAD
KENTUCKY AVENUE
SR 472
I-4 - SR 400
CR 4145 (HOWLAND BLVD)
CR 4145 (GRAVES AVENUE)
NORMANDY BLVD.
ELCKAM BLVD.
SAXON BLVD.
VETERANS MEMORIAL PKWY.
RHODE ISLAND
RAMP A
RAMP B
RAMP C
RAMP D
RAMP E
RAMP G
LOC•1
LOC•2
LOC•3
LOC•4
LOC•5
LOC•6
LOC•7
LOC•8
LOC•9
LOC•10
LOC•11
LOC•12
LOC•13
LOC•14
LOC•15
LOC•16
LOC•17
LOC•18
LOC•19
LOC•20
LOC•21
N
NTS
REVISIONS
DATE | BY | DESCRIPTION | DATE | BY | DESCRIPTION
C. BRIAN FULLER, P.E. # 49524
METRIC ENGINEERING, INC.
2288 LEE ROAD - SUITE 220
WINTER PARK, FLORIDA 32789
TEL: (407) 644-4888
FAX: (407) 644-1821
FLORIDA CERT. NO. EB-0002294
ENGINEERS
PLANNERS
SURVEYORS
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION
ROAD NO. | COUNTY | FINANCIAL PROJECT ID
400 | VOLUSIA | 242716-1-52-01
TRAFFIC CONTROL PLAN
I-4 CLOSURE DETAIL
SHEET NO.
248 9

VARIABLE MESSAGE SIGN DISPLAY (LOC #4)		
WORK ZONE CONDITIONS	DISPLAY 1	DISPLAY 2
I-4 CLOSED	I-4 WB CLOSED	DETOUR STRAIGHT AHEAD

VARIABLE MESSAGE SIGN DISPLAY (LOC #5)		
WORK ZONE CONDITIONS	DISPLAY 1	DISPLAY 2
I-4 CLOSED	I-4 WB CLOSED	I-4 WB DETOUR TURN RT

VARIABLE MESSAGE SIGN DISPLAY (LOC #12)		
WORK ZONE CONDITIONS	DISPLAY 1	DISPLAY 2
I-4 CLOSED	I-4 EB CLOSED	I-4 EB DETOUR TURN LT

VARIABLE MESSAGE SIGN DISPLAY (LOC #16)		
WORK ZONE CONDITIONS	DISPLAY 1	DISPLAY 2
I-4 CLOSED	I-4 EB CLOSED	I-4 EB DETOUR TURN RT

VARIABLE MESSAGE SIGN DISPLAY (LOC #17)		
WORK ZONE CONDITIONS	DISPLAY 1	DISPLAY 2
I-4 CLOSED	I-4 WB CLOSED	DETOUR AHEAD

VARIABLE MESSAGE SIGN DISPLAY (LOC #20)		
WORK ZONE CONDITIONS	DISPLAY 1	DISPLAY 2
I-4 CLOSED	I-4 EB CLOSED AT SAXON	I-4 EB DETOUR TURN LT

VARIABLE MESSAGE SIGN DISPLAY (LOC #21)		
WORK ZONE CONDITIONS	DISPLAY 1	DISPLAY 2
I-4 CLOSED	I-4 EB TURN RT	I-4 WB TURN LT

C. Brian Fuller
5/23/06
STATE OF

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

• ENGINEERS
• PLANNERS
• SURVEYORS

C. BRIAN FULLER, P.E. # 49524
METRIC ENGINEERING, INC.
2269 LEE ROAD - SUITE 200
WINTER PARK, FLORIDA 32789
TEL. (407) 644-1898
FAX. (407) 644-1921
FLORIDA CERT. NO. EB-0002294

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
400	VOLUSIA	242716-1-52-01

TRAFFIC CONTROL PLAN
I-4 CLOSURE DETAIL

SHEET NO. 248 R

Appendix N

Example Specification for Settlement Report for Temporary Shoring on Shallow Foundations

Settlement Report for Temporary Shoring on Shallow Foundations

The Contractor's geotechnical engineer shall calculate total long-term settlement at each temporary shoring location with allowance for deck form weight, deck self-weight, and weight of the construction equipment required to place the deck concrete. References for recommended settlement calculation methodology are given below. The calculations should be based on structural borings taken at the temporary shoring locations. The results of consolidation calculations at each temporary shoring location should be plotted on a time-settlement curve and included in the report. For high-organic-content materials (organic content greater than 20%), total settlement estimates should be based on primary consolidation and secondary compression (creep) settlements. In these cases, creep estimates must be based on coefficient of secondary compression values obtained from laboratory consolidation test results. Special attention is necessary if dewatering operations are required in the vicinity of the staging area.

The Contractor's geotechnical engineer shall propose ground improvement methods under temporary shoring bents as necessary. Options may include:
- Preload temporary shoring bents,
- Rigid construction mats, and
- Dynamic compaction.

If preloading is necessary, it shall be maintained until at least 90% of the total expected (calculated) settlement has occurred.

The Contractor's structural engineer shall set differential settlement thresholds consistent with the boundary conditions used in the continuous superstructure calculation.

The report shall include a detailed settlement monitoring plan that addresses ground movements during and after the deck pour. The plan shall set survey target locations on temporary shoring and monitoring intervals with provisions for jacking under each beam line at support locations. The Report should also include a field survey of permanent bridge supports with remedial action such as pedestal grinding or bearing shims as necessary.

References:

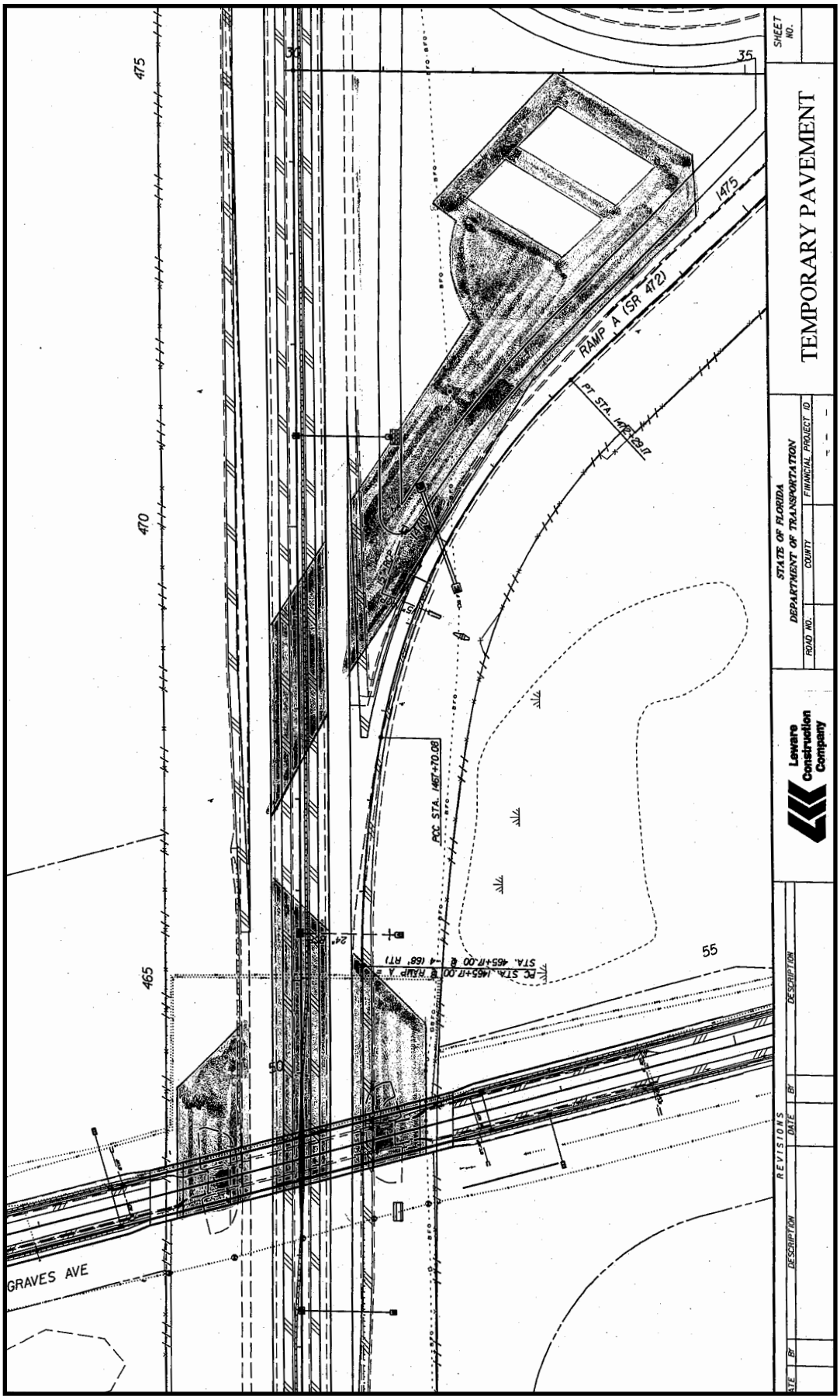
Duncan, J.M. and Buchignani, A.L., *"An Engineering Manual for Settlement Studies,"* Department of Civil Engineering, University of California, Berkeley, 1976.

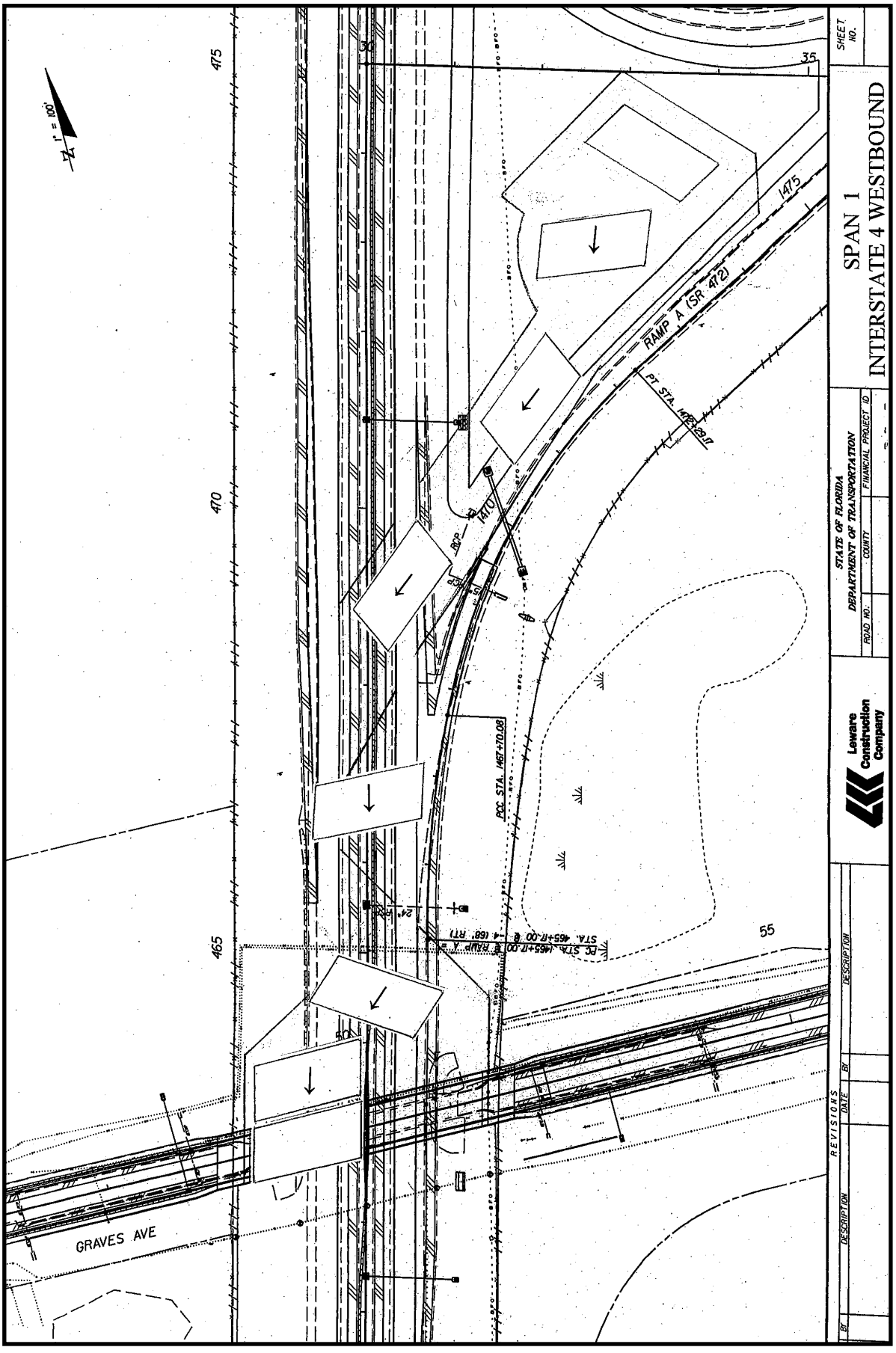
Cheney, R.S. and Chassie, R.G., *Soils and Foundations Workshop Manual-Second Edition,* FHWA HI-88-009, 1993.

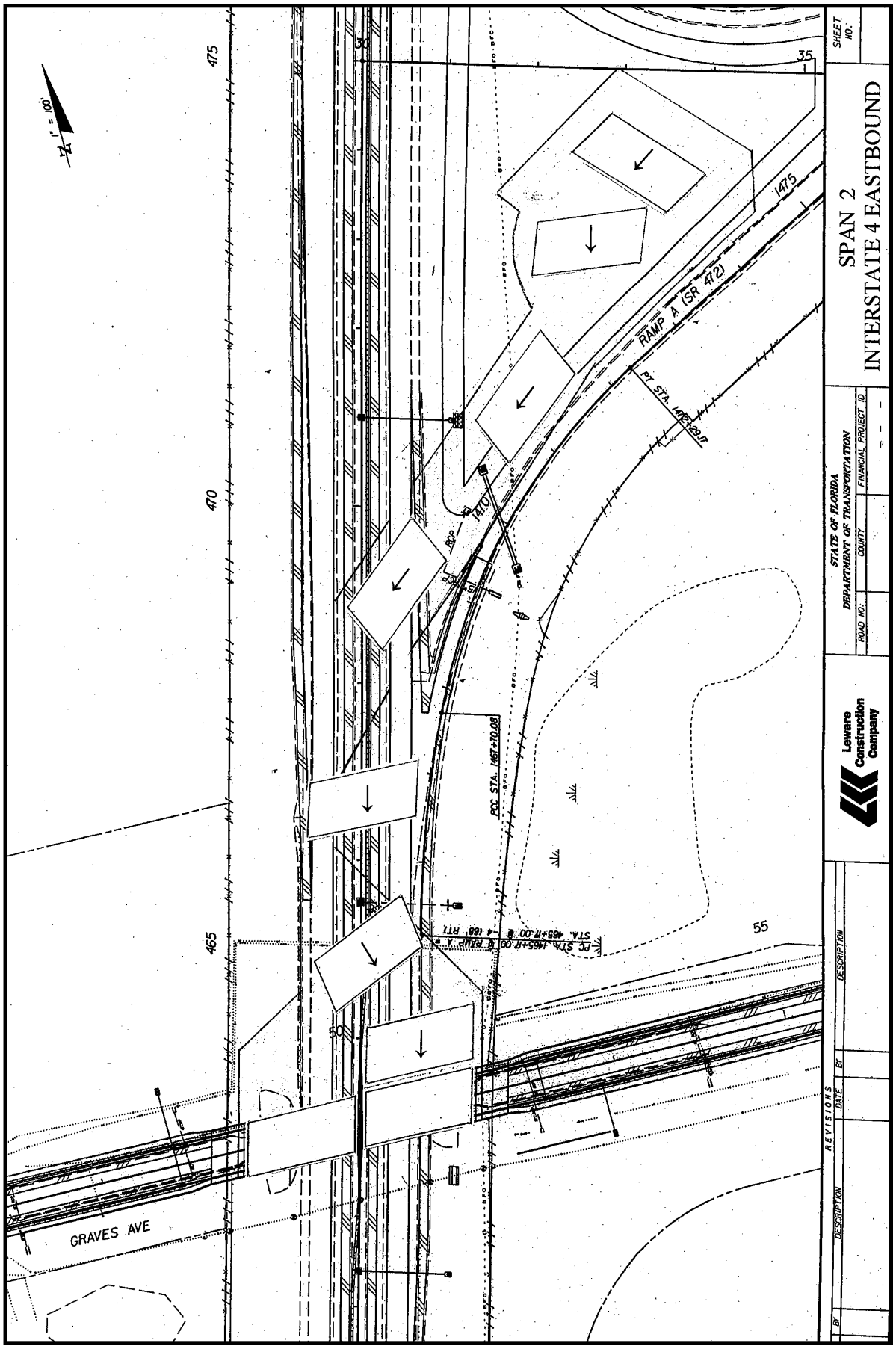
Appendix O

Example Diagrams for Path and Motion

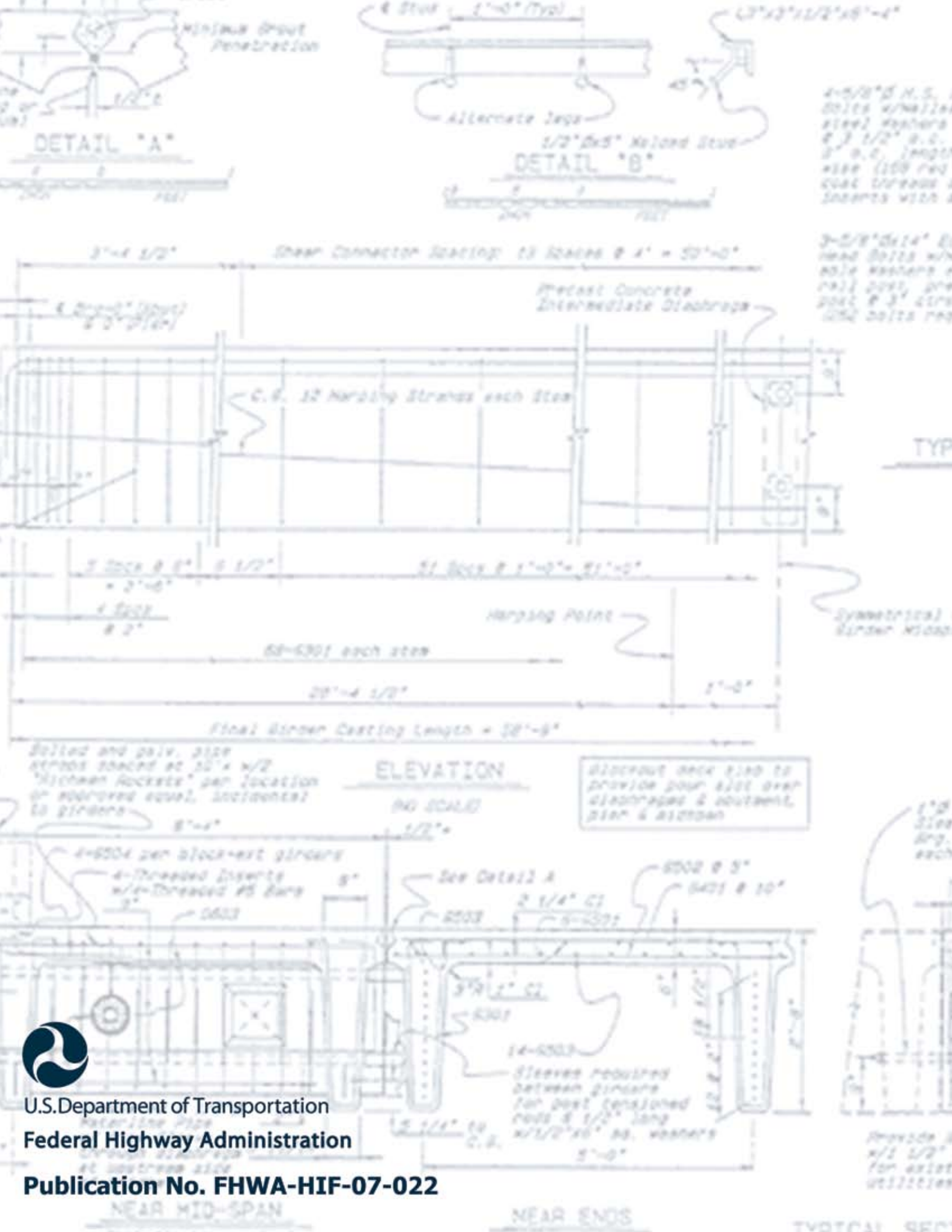
FDOT Graves Avenue/ I-4 Project




SPAN 1
INTERSTATE 4 WESTBOUND
SHEET NO.
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION
ROAD NO:
COUNTY:
FINANCIAL PROJECT ID:
Lewaro Construction Company
REVISIONS
DESCRIPTION
DATE
BY
1" = 100'
RAMP A (SR 423)
PT STA. 1472+29.17
PCC STA. 1467+70.08
PC STA. 1465+71.00 ℄ RAMP A
STA. 1465+71.00 ℄ = 168' RT.
GRAVES AVE
475
470
465
1470
1475
30
35
55
60
80°
24'


SPAN 2
INTERSTATE 4 EASTBOUND
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION
Leware Construction Company
RAMP A (SR 472)
GRAVES AVE
PC STA. 1467+70.08
PT STA. 1482+28.17
1" = 100'
REVISIONS
DESCRIPTION
DATE
BY

DETAIL "A"
DETAIL "B"
Shear Connector Spacing: 13 Spaces @ 4" = 52'-0"
Precast Concrete Intermediate Diaphragm
ELEVATION
NEAR MID-SPAN
NEAR ENDS
TYPICAL



U.S.Department of Transportation

Federal Highway Administration

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