KEEGAN WERLIN LLP

ATTORNEYS AT LAW
265 FRANKLIN STREET
BOSTON, MASSACHUSETTS 02110-3113

(617) 951-1400

TELECOPIERS:
(617) 951-1354
(617) 951-0586

October 2, 2006

Mary L. Cottrell, Secretary
Department of Telecommunications and Energy
One South Station, 2nd Floor
Boston, Massachusetts 02110

Re: Investigation of Rates to be Charged by the Massachusetts Turnpike Authority for Wireless Providers, D.T.E. 06-70

Dear Ms. Cottrell:

In accordance with the procedural schedule established by the Department of Telecommunications in the above-referenced proceeding, the Joint Carriers[1] present the Direct Testimony of the following witnesses, with supporting exhibits:

- **Paul B. Vasington**, on behalf of Verizon Wireless, with the concurrence of the Joint Carriers. Mr. Vasington's testimony provides an overview of the MTA's proposal for rates supporting the installation, construction, operation and maintenance of a carrier-neutral shared antenna wireless telephone communication system in the CA/T Project and an analysis of whether the MTA's rate proposal is appropriately formulated and reasonable, as mandated by Section 115 of Chapter 123 of the Acts of 2006.

- **Ronald W. Buia, P.E.**, on behalf of the Joint Carriers. Mr. Buia's testimony responds to certain engineering, technical and cost-estimating aspects of the MTA's rate proposal.

Please note that the above-referenced Direct Testimony was developed based on the very limited information available through the MTA's initial filing, and without the benefit of the responses of Massachusetts Turnpike Authority ("MTA") to information requests

[1] For the purposes of this filing, please note that the "Joint Carriers" are Bell Atlantic Mobile of Massachusetts Corporation, Ltd. d/b/a Verizon Wireless, New Cingular Wireless PCS, LLC and Sprint Spectrum L.P. and Nextel Communications of the Mid-Atlantic, Inc

issued by the Joint Carriers on September 19, 2006. Accordingly, the Joint Carrier's must reserve the right, upon future review of the MTA's responses to information requests in this proceeding, to file supplemental testimony, modifications to the existing testimony, or as necessary, to file the testimony of an additional technical expert.

Please do not hesitate to contact me if you have any questions or if I can provide you with any additional information.

Thank you very much for your attention to this matter.

Sincerely,

Robert J. Keegan (CMK)

Robert J. Keegan

Enclosure

cc: John J. Keene, Hearing Officer
Jesse Reyes, Hearing Officer
Service List

COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF TELECOMMUNICATIONS AND ENERGY

Investigation by the Department of Telecommunications and Energy on its own motion pursuant to Chapter 123 of the Acts of 2006, § 115, to establish the maximum rates and fees to be charged by the Massachusetts Turnpike Authority to wireless providers for the placement and use of Wireless attachments in the central artery tunnels.	**)**	**Docket No. 06-70**

DIRECT TESTIMONY OF RONALD W. BUIA, P.E.

EXHIBIT JC-RWB-1

On Behalf of the Joint Carriers:

New Cingular Wireless PCS, LLC
Sprint Spectrum L.P. and Nextel Communications of the Mid-Atlantic, Inc.
Bell Atlantic Mobile of Massachusetts Corporation, Ltd. d/b/a Verizon Wireless

October 2, 2006

COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF TELECOMMUNICATIONS AND ENERGY

EXHIBIT JC-RWB-1

DIRECT TESTIMONY OF RONALD W. BUIA, P.E.

D.T.E. 06-70

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND OCCUPATION.

A. My name is Ronald W. Buia. I am the President and Chief Electrical Engineer of Ronald W. Buia, Inc., Electrical Engineers, 1600 Osgood St., Bldg. 20, Suite 2-89, North Andover, MA 01845. I am also President and Chief Electrical Engineer of Ronald W. Buia Engineering, P.C., located in Argyle, New York.

Q. WHAT ARE YOUR QUALIFICATIONS?

A. I am a Registered Professional Engineer ("P.E.") in Massachusetts. I was first licensed as a P.E. by exam in the State of New York in 1976. I am also licensed as a P.E. in Connecticut, Maine, New Jersey, Pennsylvania, Rhode Island, Vermont, New Hampshire, North Carolina and Georgia.

Q. WHAT IS YOUR EDUCATIONAL AND PROFESSIONAL BACKGROUND?

A. I earned a Bachelor of Science Degree in electrical engineering from Merrimack College in North Andover, Massachusetts. I have served as President and Chief Electrical Engineer of Ronald W. Buia Engineering, P.C. (Argyle, NY) since its inception in 2000. I have served as President and Chief Electrical Engineer of

Ronald W. Buia, Inc. since its inception in 1984. Prior to its formation, I was Lead Electrical Engineer for Chas. T. Main, Inc., Industrial Division, Boston, MA (1981-1984); Metcalf & Eddy International, Houston, TX (1979-1981); and Metcalf & Eddy, Inc. Boston, MA (1977-79). I was an electrical engineer for Malcolm Pirnie, Inc. and Raytheon Co. and was President of Buia Electrical Contractors, Inc. from 1973 to 1974. I am the past President of the Massachusetts, North Shore Chapter of the National Society of Professional Engineers.

As President and Chief Electric Engineer of Ronald W. Buia, Inc., I have substantial experience with the installation of wireless communications equipment, having worked on approximately 1,000 cell sites across the New England region. I was involved in the installation of the Verizon Wireless systems in both the Sumner and Callahan tunnels, where my responsibility included including bringing power to the cell site equipment and grounding. I also worked on the Prudential Tunnel telecom installation and the Ted Williams Tunnel in the same capacities.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. I am presenting testimony on behalf of the Joint Carriers ("JC")[1] in response to certain engineering, technical and cost-estimating aspects of the proposal submitted to the Department of Telecommunications and Energy ("Department") by the Massachusetts Turnpike Authority ("MTA") on September 13, 2006. Specifically, my testimony addresses the following issues: (1) a conduit-based installation is not needed nor required for the System; (2) the MTA has not properly calculated the linear feet of conduit that would be used by the System (as designed by the MTA and Maverick/Mikom) to house fiber-optic cable, even if the conduit were to be used; (3) the MTA has apportioned 100 percent of the useable conduit space to the System, although 80 to 90 percent of the useable space would remain available for future, alternative uses; (4) the MTA's approach and calculation of cost of the conduit installation is internally inconsistent and vastly overstated; and (5) the MTA has not computed the appropriate useable space that will be devoted to the System in Vent Building 6 or the 28 pre-existing utility rooms.

[1] For the purposes of this testimony, the Joint Carriers are New Cingular Wireless PCS, LLC ("Cingular"), Sprint Spectrum L.P. and Nextel Communications of the Mid-Atlantic, Inc. ("Sprint-Nextel") and Bell Atlantic Mobile of Massachusetts Corporation, Ltd. d/b/a Verizon Wireless ("Verizon Wireless").

Q. WHAT MATERIALS HAVE YOU REVIEWED IN PREPARATION OF YOUR TESTIMONY?

A. To prepare my testimony, I reviewed the entirety of the MTA's September 13th filing, including the Proposal and Exhibit A (Description of Useable Space), Exhibit B-1 (Tunnel Raceway Replacement Cost Estimate), Exhibit B-2 (Additional Costs of System Construction) and Exhibit C (Description of System). Although not identified by the MTA in its filing, Exhibit C presents *an excerpted portion* of the Request for Proposal ("RFP") response submitted to the MTA on September 12, 2002, by its "Selected Vendor," which is Maverick Construction Corporation partnering with Mikom, an Allen Telecom Company (hereinafter referred to as "Maverick/Mikom").[2] As set forth by the MTA in its Vendor and Carrier RFPs[3], the MTA selected Maverick/Mikom to construct and maintain a carrier-neutral shared antenna wireless telephone communications system (the "System") in the Central Artery/Tunnel Project ("CA/T Project"). Installation of the System was to occur within three phases of the CA/T Project, which are the Seaport Access Roadway (Phase 1), the Northbound Artery (Phase 2) and the South Bound Artery (Phase 3).

In addition to the MTA's Proposal and related exhibits, I reviewed the Vendor and Carrier RFPs issued by the MTA on July 10, 2002 and January 30, 2003, respectively, as well as a document entitled "Answers to Carrier Questions,"

---

[2] MTA Proposal at 3.

[3] The Vendor and Carrier RFPs are referenced in the MTA's Proposal at 3 and are provided as attachments to the Testimony of Paul B. Vasington, filed on this date by the Joint Carriers.

dated April 28, 2003, which contains written answers and documentation prepared by Maverick Construction Corporation in response to questions posed by the wireless carriers participating in the MTA's Carrier RFP. The document entitled "Answers to Carrier Questions" is provided herewith as Exhibit JC-RWB-2.

I also reviewed a document entitled "Mass. Turnpike Authority Requests for Proposals CA/T Wireless Project – Carrier RFP; Appendix D: Answers to Questions" dated August 22, 2002, which contains written answers and documentation prepared by the MTA in response to questions posed by the vendors participating in the MTA's Vendor RFP. This document is provided herewith as Exhibit JC-RWB-3.

Lastly, I reviewed the applicable electrical codes and engineering specifications for the items discussed below, and published reports of materials and labor costs.

Q. WAS THE INFORMATION AVAILABLE FOR YOUR REVIEW SUFFICIENT TO FULLY ADDRESS THE ISSUES BEFORE THE DEPARTMENT IN THIS PROCEEDING?

A. No. At this time, the MTA has not provided sufficient information or documentation for me to render an opinion to fully address the issues before the Department in this proceeding. The MTA's initial filing provided very limited, unsupported, summary information and its responses to discovery were not timely filed, and therefore, were not available at the time of this writing. Moreover, critical supporting documentation relating to the (1) costs associated with the Maverick/Mikom proposal for the construction, operation and maintenance of the

System, and (2) costs associated with the MTA's Proposal for tunnel access, are not yet available. Until the MTA submits this supporting documentation, I am unable to complete my review of the cost components of the MTA's CA/T Wireless Project. I also anticipate participating in a site walk of the CA/T Project, which the Joint Carriers requested from the MTA, but has not yet occurred.

Therefore, while I was able to make some preliminary assessments of the MTA's Proposal as submitted to the Department on September 13, 2006, I would like to reserve the right to supplement or modify this testimony as necessary to reflect more complete information when it is received.

II. A CONDUIT-BASED INSTALLATION IS NOT NECESSARY OR COST-EFFECTIVE

Q. WHAT IS THE PRIMARY COST COMPONENT OF THE MTA'S PROPOSAL FOR THE INSTALLATION OF THE SYSTEM?

A. As stated in the MTA's Proposal (at page 5) and set forth in Exhibits B-1 and B-2, the MTA calculates that its "Total Cost" associated with the construction, operations, and maintenance of the System is approximately $15,008,968.95. Based on my review of the MTA's filing, this total *does not include* the Maverick/Mikom construction and installation costs of approximately $10 million, nor approximately $1 million in annual operating and maintenance costs. Rather, the MTA's Total Cost of $15,008,968.95 covers the following (five) cost components: (1) the "replacement cost" of installing conduit to accommodate the

System (although the MTA is proposing to use conduit that was installed during tunnel construction); (2) the cost of space within Vent Building 6, in which System equipment will be located; (3) the cost of constructing 28 pre-existing utility rooms, in which System equipment will be located; (4) the MTA's to-date cost of outside consultants relating to the planning, pre-construction and project-management activities relating to the installation of the System; and (5) the Authority's projected expenditures in connection with the same activities.[4]

By far, the bulk of the MTA's Total Cost of $15 million is represented by the first cost component, which is the "replacement cost" of conduit that the MTA states will be used to house the System. Of the total $15 million in alleged costs put forth by the MTA, approximately $12,750,333 is the cost associated with the installation of conduit to house the fiber-optic cable composing the System.

Q. IS CONDUIT NEEDED FOR THE INSTALLATION OF A SAFE AND RELIABLE COMMUNICATIONS SYSTEM WITHIN THE CA/T PROJECT?

A. Not at all. With the exception of a relatively short stretch of fiber-optic cable that will be needed from the tunnel to the vent buildings (where conduit is the only access available), there is no need for the cable to be encased in conduit. In fact, during the bidding process, the MTA provided written answers to questions on the Vendor RFP (dated August 22, 2002), which state in several places that cable may be installed outside the conduit. These responses are submitted herewith as

[4] MTA Proposal at 5; Exhibit B-1.

Exhibit JC-RWB-3 (see answers to Questions 24-25, 28-31). My engineering analysis set forth below confirms this from the point of view of code compliance, reliability and feasibility.

Q. IS INSTALLATION IN CONDUIT NECESSARY TO COMPLY WITH APPLICABLE ELECTRICAL, BUILDING AND SAFETY CODES?

A. No. The Massachusetts Electrical Code does not require fiber-optic cable to be installed in a conduit for the System. For example, a fiber-optic cable could be attached to the tunnel wall or placed in a plenum (a crawlspace) or other available space in compliance with all applicable electrical, building and safety codes (as well as MTA requirements set in other tunnels).

Q. IS SOME PROTECTION REQUIRED FOR CABLE THAT IS INSTALLED OUTSIDE OF CONDUIT?

A. Yes. A fiber-optic cable installed outside of conduit will require some kind of external protection against external physical impacts. A type of fiber-optic cable commonly installed outside of conduit is "armored cable," which is a fiber-optic cable covered in a strong, yet pliable sheath of insulating material. Armored cable, particularly if placed in a plenum (or other location such as a wall or ceiling) away from traffic has no increased risk of failure due to accident or contact. In addition, non-armored cable may be placed in "inner-duct" (flexible plastic tubing) and attached to the tunnel wall.

A cable installed in the plenum would need to have low-smoke insulation, which is accomplished using low-smoke halogen casing and without using plastics,

which tend to generate more smoke. Hardware for a non-conduit installation may be galvanized or stainless to avoid rust or deterioration from weathering. An appropriate system design can easily accommodate the restriction against laying coaxial cable over electric wires.

Q. IS THERE ANY ENGINEERING JUSTIFICATION FOR THE USE OF CONDUIT IN THE INSTALLATION OF THE MAVERICK/MIKOM SYSTEM?

A. No. The installation of armored cable on tunnel surfaces or in plenums is feasible from an engineering perspective and, in fact, is the mode of installation in both the Sumner and Callahan Tunnels.

Q. IS THE USE OF ARMORED CABLE OUTSIDE OF CONDUIT MORE COST-EFFECTIVE THAN THE MTA'S PROPOSAL?

A. Yes. In terms of an "order of magnitude," the cost of materials involved in the installation of armored cable would be approximately $8.15 per linear foot, and the cost of labor to install armored cable would be approximately $8.87 per linear foot, for a total direct cost of $17.02 per linear foot, as shown on Exhibit RWB-4. The approximate installed cost would be about $25.36 ($17.02 x 1.29 for indirect costs x 0.1 for overhead x 0.1 for profit). Since it would be installed *outside* of the conduit, the cost of installing the conduit is eliminated. Note that I have calculated below that a reasonable installed cost of cable installation in the MTA's existing conduit is $75.74 per linear foot (plus $5 per linear foot for the cable), as shown on Exhibit RWB-6. According to the MTA's Proposal (at

Exhibit B-1) the total cost of installing *just the conduit* is $338.25 per linear foot. The cost of the installing the System is entirely separate and is currently estimated by the MTA at $10 million.

III. THE CALCULATION OF LINEAR FEET OF CONDUIT TO BE USED IS OVERSTATED, EVEN IF CONDUIT WERE TO BE USED.

Q. DOES MTA'S PROPOSAL OVERSTATE THE LINEAR FOOTAGE TO BE USED IN THE INSTALLATION OF THE SYSTEM?

A. Yes. It does not appear that MTA has incorporated the actual linear footage of the cable as contemplated in the Maverick/Mikom proposal, or the fact that the System will not need to utilize cable in every linear foot of the tunnels and ramps encompassed in the CA/T Project.

Q. HOW DOES MTA CALCULATE THE LINEAR FOOTAGE OF CABLE TO BE INSTALLED WITHIN THE CA/T PROJECT?

A. As stated in the MTA's Proposal (at page 4), Exhibit A and Exhibit B-1, the MTA arrives at a total conduit length of 37,695 linear feet by simply summing the number of linear feet of the tunnel roadways and ramps. The MTA has failed to make any assessment of the number of linear feet of conduit that would *actually* be used to house the fiber-optic cable per the Maverick/Mikom design.

Q. WERE YOU ABLE TO IDENTIFY THE ACTUAL NUMBER OF LINEAR FEET OF CONDUIT THAT WOULD BE USED IF THE SYSTEM WERE CONSTRUCTED CONSISTENT WITH THE MAVERICK/MIKOM DESIGN?

A. No. I was not. The information made available to date by the MTA is not sufficient for me to be sure about the actual number of linear feet of conduit that

would be required. However, based upon the information that I was able to review, I am certain that the total is not 37,695 linear feet.

Q. WHAT IS THE BASIS OF YOUR ASSESSMENT?

A. There are several reasons that the MTA's total is inaccurate. First, the MTA's Proposal apparently anticipates that parallel fiber-optic runs would be installed throughout the entire length of the CA/T Project to serve the anticipated antennas (i.e., on each side of the roadway). However, it is not necessary to install parallel fiber-optic cables throughout the entire length of the CA/T Project. In fact, parallel segments of the tunnel-roadway system would be served by a single fiber-optic backbone cable, with lateral cables branching off the backbone to connect to remote units. Specifically, the remote units would be served by relatively small bundles of lateral strands composed of roughly 12 to 24 fibers (depending on the number of remote units), which would not be installed in the MTA's existing conduit because the lateral strands do not require conduit at all. Because the MTA has calculated the total linear feet of conduit by summing the linear feet of the CA/T Project roadways and ramps (in Exhibit A), the MTA has greatly overstated that number of linear feet of conduit that would be utilized by the System. In addition, the Maverick plans show that the last antenna cluster in each tunnel is located at some distance from the tunnel opening. There is no need for cable attachments between the last antenna and the tunnel opening.

Q. CAN YOU ESTIMATE THE ACTUAL NUMBER OF LINEAR FEET OF CONDUIT TO BE OCCUPIED BY THE INSTALLED SYSTEM AS CONTEMPLATED BY THE MAVERICK/MIKOM DESIGN PROPOSAL?

A. No, I cannot pinpoint the actual number of linear feet of conduit that would be used because the MTA has not provided sufficient information to do this. I believe that there may be areas other than the ones discussed above where it is not necessary to run fiber-optic cable within the tunnels, but the MTA has not analyzed this issue. In fact, the linear footage of the mainline tunnel roadways is the best estimate of the appropriate linear footage and is certainly is closer to the actual number than the total number proposed by the MTA. The mainline fiber-optic backbone would be approximately 11,300 linear feet (for I-93 northbound and I-93 southbound). It should be noted that the Seaport Access backbone (which the MTA has not considered) would add approximately 5,400 linear feet, for a total of 16,700 linear feet.

Q. IS THERE ANOTHER WAY TO APPROACH THIS ISSUE?

A. Yes. If the exact number of linear feet required for actual wireless attachments cannot be determined, the Department could set a rate per linear foot, and require a survey or audit to determine the actual linear footage of existing conduit provided by the MTA that would be occupied by the wireless attachments. If this alternative were implemented, the linear footage of any installed armored cable, newly installed conduits or ducts to protect cabling, if necessary or required, would not be included in the survey or audit for the purpose of determining the

per linear foot cost (because the per linear foot cost relates only to the use of the MTA's existing conduit and not to other components of the System).

IV. PERCENTAGE OF CONDUIT ALLOCATED TO THE SYSTEM

Q. HAS THE MTA OVERSTATED THE PERCENTAGE OF CONDUIT TO BE ALLOCATED TO THE PROPOSED WIRELESS ATTACHMENTS?

A. Yes. The MTA has not accounted for the percentage of the conduit space that would remain available for other uses after installation of the System.

Q. WHAT DOES THE MTA USE FOR THE PERCENTAGE OF THE CONDUIT TO BE OCCUPIED BY THE INSTALLED SYSTEM?

A. On Exhibit B-1, the MTA simply multiplies the total number of linear feet computed in Exhibit A (which is inaccurate) times the cost per linear foot of conduit computed in Exhibit B-1 (which is overstated). The MTA does not make any adjustment for the percentage of conduit that will remain available for other users in the future. As a result, the calculation in Exhibit B-1 anticipates that 100 percent of the cost of the conduit would be apportioned to the Carriers without any consideration of the fact that there is substantial available space left in the conduit that would be available at the MTA's discretion for use in other applications. In fact, by my calculations, approximately 80 to 90 percent of the useable conduit will remain available to the MTA after installation of the Maverick/Mikom system.

Q. HOW DID YOU CALCULATE THE PERCENTAGE OF THE CONDUIT THAT WILL BE ALLOCATED TO THE SYSTEM?

A. First, I determined the diameter of the cable type set forth in the Maverick/Mikom proposal by (1) identifying the capacity of the cable, which is a function of the number of optical fibers inside the cable, and (2) consulting specifications available in industry publications for the diameter of in-conduit cables having that capacity.

Second, I determined the cross sectional area of the conduit and the proposed cable by multiplying the square of the radius (one-half of the diameter) of each item by $\prod$.

Third, I consulted the Massachusetts Electrical Code, which restricts useable space to 40 percent of the conduit area if electrical cables are installed as measured in square inches. Then, I divided the cross-sectional area of the fiber-optic cable (in square inches) by the cross-sectional area of the conduit (in square inches), and multiplied by 40 percent.

Q. WHAT IS THE CAPACITY OF THE FIBER OPTIC CABLE ACCORDING TO THE MAVERICK PROPOSAL?

A. The Maverick/Mikom proposal anticipates the use of 432 fibers to support not only this System, but also future users and a redundancy/reserve capacity. Although this is greater capacity than the System would really need, I used the 432-fiber figure to determine the diameter of the cable.

Q. ACCORDING TO INDUSTRY PUBLICATIONS, WHAT IS THE DIAMETER OF A FIBER-OPTIC CABLE CAPABLE OF SERVING 432 STRANDS?

A. The diameter of the 432-fiber cable is 0.84" in diameter, with a cross sectional area of 0.55 square inches.

Q. WHAT IS THE DIAMETER OF THE MTA'S CONDUIT?

A. According to Exhibit B-1 (in the spread sheet following page 12), the diameter of the conduit referenced for the cost estimate is 4 inches.[5] However, in the MTA's Proposal (at page 8), the MTA notes that it currently has spare 3-inch conduit available. The Carriers hope to identify the correct number through this proceeding. However, given the time constraints of this proceeding, I have performed the calculations for both the 4-inch and 3-inch diameter, so that the record will be complete once this number is known.

Q. HOW MUCH USABLE SPACE DOES THE MTA'S CONDUIT CONTAIN?

A. Given the basic relationship that the cross-sectional area of the conduit is Pi (3.1416) times the square of the radius (2"^{2}), there is about 12.56 square inches of 4" conduit available to house the 0.55 square-inch fiber-optic cable housing the System anticipated in the Maverick/Mikom proposal. For a 3" diameter (1.5" radius) , there would be about 7 square inches available in the conduit cross-section.

---

[5] Standard practice for diameter measurements of conduit is to measure the inner diameter of the conduit, but the outer diameter of the cable. See Exhibits JC-RWB-5 and JC-RWB-6.

Q. HOW MUCH SPACE WITHIN EACH CONDUIT IS AVAILABLE FOR THE SYSTEM AND OTHER ATTACHMENTS?

A. Based upon the Massachusetts code requirement discussed above limiting the useable space of the conduit to 40 percent of the total 4" conduit area, there are about 5 square inches available for the 4" conduit size and 2.8 square inches available for a 3" conduit.

Q. WHAT PERCENTAGE OF THE CONDUIT WOULD BE ALLOCATED TO THE SYSTEM AS PROPOSED BY MAVERICK/MIKOM?

A. The calculation of required space with a 4" conduit is approximately 11 percent (0.55 square inches divided by 5 square inches multiplied by 100). The calculation of required space with a 3" conduit is approximately 19.6 percent (0.55 square inches divided by 2.8 square inches times 100). In either case, only a fraction of the MTA's alleged conduit cost would be attributable to the "percentage" occupied by the System, if the conduit were used at all. Specifically, for a 3" conduit, about 20 percent of the conduit's "usable space" would be occupied; and for a 4" conduit, only about 11 percent of the conduit's "usable space" would be filled.

I have prepared a couple of diagrams to illustrate the very limited extent of the System's use of conduit, if conduit were even used in installing the System. Exhibit JC-RWB-5 is a "Conduit Detail" showing a 0.84" diameter fiber cable inside a 4" diameter conduit and setting forth the calculations that support my

conduit detail and the testimony above. Exhibit JC-RWB-6 shows the same thing for the 3" diameter conduit.

V. REASONABLENESS OF THE MTA'S PROPOSED COSTS FOR CONDUIT

Q. HAVE YOU REVIEWED THE ACCURACY AND REASONABLENESS OF THE MTA'S PROPOSED COSTS FOR "REPLACING" THE CONDUIT?

A. Yes. I understand that, in this proceeding, the accuracy and reasonableness of the costs upon which any "cost-based" rate or fee would be established by the Department. In addition, Mr. Vasington explains in his testimony that the MTA has inappropriately used a "replacement cost" approach, rather than a methodology that computes that actual cost of the conduit installation. Therefore, to determine whether the costs set forth by the MTA in Exhibit B-1 and B-2 are accurate and reasonable in terms of an actual-cost approach, I consulted well-accepted and generally available industry data providing information on the costs at the time the conduit was constructed by the MTA.

Q. IN YOUR OPINION, ARE THE MTA'S PROPOSED COSTS ON MTA'S EXHIBIT B-1 AND B-2 ACCURATE OR REASONABLE?

A. No. The linear-foot and cost estimates set forth by the MTA on Exhibit A and Exhibit B-1, respectively, are internally inconsistent because the costs set forth in Exhibit B-1 relate to the installation of *an overhead 4" diameter, conduit-based system*, although the System would be installed in the existing, *spare 3" diameter conduit located in a concrete-encased ductbank*, as referenced in Exhibit A (at

page 8, 10), if the conduit were even used. In addition, the costs set forth by the MTA are vastly overstated and are in no way justifiable or reasonable in light of generally available engineering and construction cost data.

Q. FROM AN OVERALL PERSPECTIVE, WHAT ARE THE ERRORS THAT EXIST IN THE MTA'S COST ESTIMATE SET FORTH IN EXHIBIT B-1?

A. As an initial matter, there are two types of errors that pervade the MTA proposal: (1) the MTA has based its cost estimation on materials and equipment that would be not be used in a conduit-based installation; and (2) the MTA has patently overestimated the cost of materials that would be used in a conduit-based installation.

Specifically, the MTA assumes higher-cost materials than would ever be necessary for the project (e.g., the use of stainless-steel conduit in the ductbank). In fact, the type of conduit installed is an important detail that the MTA has yet to make available in this proceeding. The MTA's proposal (p. 10) specifies the use of galvanized rigid steel or fiberglass reinforced epoxy conduit if conduit is required. Moreover, I believe it would be *highly* unlikely that the MTA installed stainless-steel conduit because it would not be consistent with generally accepted engineering or construction practice, and even if it was installed, the Carriers should not be charged for this premium conduit.

In addition, the MTA's cost estimate is not even consistent with the type of application that it actually installed. Instead of pricing a concrete-encased duct bank, the MTA priced the installation as if the conduit were to be installed on the ceiling and walls of the tunnel.

In Exhibit JC-RWB-7, I have made a number of adjustments to the figures set forth in Exhibit B-1 (as discussed below) and I have recalculated the linear per-foot cost of the 4" diameter conduit used in Exhibit B-1. In Exhibit JC-RWB-8, I have performed the same cost analysis assuming the use of 3" conduit, as specified in Exhibit A in the MTA's proposal, as well as the Vendor and Carrier RFPs.

Q. WHAT IS A REASONABLE ESTIMATE FOR THE OVERALL COST, ON A PER-FOOT INSTALLED BASIS, FOR THE CONDUIT SYSTEM LOCATED IN THE CA/T PROJECT AT THE TIME IT WAS BUILT?

A. Reasonable direct costs for labor and materials, are approximately $55.40 per linear foot for 4" rigid steel conduit and approximately $43.50 per linear foot for 3" rigid steel conduit, as explained in detail below. If you add indirect costs using the same method as the MTA (i.e., by calculating each indirect item as a percentage of labor), and include a 10 percent adjustments for overhead and profit margin, the total per-foot cost would be $75.75 per linear foot for 4" conduit, and about $59.52 per linear foot for 3" conduit. The details of these calculations are shown in Exhibits JC-RWB-7 and JC-RWB-8.

Q. HOW DID YOU CALCULATE YOUR ESTIMATES?

A. My estimates were based on information from electrical supply quotes and R.S. Means Estimating Books, which represents the generally accepted estimating standard. Specifically, I used the R.S. Means 2001 price quotes for equipment, except where I had current vendor quotes (which all else being equal would be higher than the cost in 2002). Although the conduit was constructed in the 2002 timeframe, 2001 prices would be very close to the 2002 prices. I did not escalate these prices, because the these prices present reasonable cost estimates of the cost that the MTA would have incurred at the time the conduit was installed (not accounting for any premiums that the MTA may have chosen to pay for its materials, which should not be charged to the Carriers).

I used the MTA's hourly cost of labor, but I did not include any labor or materials for items included in the MTA's cost estimate that would not have been necessary to the installation of conduit in a poured concrete floor, as shown on the Maverick/Mikom construction plans. Where labor was involved for items that are needed, I used the MTA's number of hours.

Q. WHAT PRICES DID YOU USE FOR MATERIALS THAT WERE NECESSARY?

A**.** For the conduit, I used a cost of $17.05 per linear foot for rigid galvanized steel (RGS) 4"conduit. At Page 2 of Exhibit B-1 (unmarked), the MTA's estimation uses a figure of $39.57 per linear foot for stainless steel conduit (AISI Type 316).

However, stainless steel would not be required for this application based on the installation specifications. Moreover, the use of stainless steel would be completely unnecessary for this application, because the galvanized steel conduit would equally endure weathering and external impacts. Given its higher cost, it is highly unlikely stainless steel would have been used for this application.

For the 45^{o} bend elbows referenced in the MTA's estimate, I used a cost of $77.50, based on an extrapolation from 2001 R.S. Means (as compared to the MTA's figure of $120.91). Extrapolation is necessary because the R.S. Means numbers are for 90^{o} elbows. Based on R.S. Means, I used $77.50 for the 4-inch 22 ½^{o} bend elbows and ground hub.

Based on a current vendor quote (i.e., the cost in today's dollars), I have identified that the cost of a 32x12x8 pull box is only $336.00. The MTA's estimated price of $4,972 is more than ten times this amount and is completely unjustifiable.

Q DOES YOUR ANALYSIS ELIMINATE ANY MATERIALS THAT THE MTA INCLUDED IN ITS ANALYSIS?

A. Yes. I did not include support channels, drilled-in anchors, SS Clamps, or Expansion/Deflection fittings, which are all included in the estimate set forth by the MTA. I also did not include the cost of using a truck-based lift as MTA did because the conduits are underground encased in concrete and no lift is needed for installation.

Q. WHY DID YOU ELIMINATE THESE ITEMS?

A. These items are not necessary or appropriate for the conduits as built. The plans for the actual installation show conduits placed in poured concrete floors. The installation of conduit in a floor ductbank does not require mounting hardware, anchors and the like. Many of the anchors and mounting hardware items that MTA includes would be eliminated (or used only in a significantly decreased quantity) for conduits in poured concrete floors. These include the items discussed in my previous answer. The same is true of the truck-based lift. If the conduit is in floor ductbank, there is little or no need for a lift. Certainly, a lift for the entire duration of the project as proposed by the MTA is not needed for installation of duct bank in the floor.

Q. WHAT IS THE USUAL PURPOSE OF THESE ELIMINATED ITEMS?

A. These items are generally used to install conduit at some height off the ground. The use of the lift throughout the project implies that the MTA has in mind attachments well off the floor, but that is not consistent with the installed facilities. Similarly, the MTA has proposed bolts and hardware to attach to the ceiling, which could only be necessary if the MTA actually planned to attach conduits to the ceiling.

Q. DID THE MTA INCLUDE COSTS FOR POLICE DETAILS IN ITS COST ESTIMATE IN EXHIBIT B-1?

A. Yes. In fact, almost <u>one-half</u> of the MTA's linear per-foot cost results from the inclusion of estimated costs for police details. Specifically, MTA carried

$145,285 per 1,000 linear feet of conduit (73 days at $2,000 per day). This is more than 42 percent of the MTA's total cost of $338,252.05 per 1,000 linear feet of conduit. For the reasons I describe below, this is extremely unreasonable and should be excluded from any calculation that is derived in this proceeding.

Q. WOULD THERE BE ANY NEED FOR A POLICE DETAIL DURING CONSTRUCTION OF THE CA/T PROJECT GIVEN THAT IT WAS NOT YET OPEN TO PUBLIC TRAFFIC?

A. No**.** The police-detail costs are completely unreasonable, given that the CA/T Project had not opened to traffic when the conduit was installed. No allowance should be made for this item. In addition, the MTA does not even divide its proposed police detail costs by the number of conduits installed in the duct bank, which means that, even if such costs were incurred, the MTA has allocated the *entire* cost to the one conduit that would be used by the System.

Q. DO YOU HAVE ANY OTHER CONCERNS ABOUT THE MTA'S PROPOSAL AS SET FORTH IN EXHIBIT B-1?

A. Yes. I have a few other concerns. First, as noted above, The MTA's cost estimate assumes the use of 4" conduit, while its narrative (at page 8) and Exhibit A, as well as its Vendor and Carrier RFPs refer to the use of 3" conduit. On Exhibit JC-RWB-7, I have estimated the cost using 4" conduit, pending verification of the diameter through this proceeding. However, if 3" rigid steel conduit were used, the price would be approximately $59.52 per linear foot for installed. That calculation is shown on Exhibit JC-RWB-8.

Second, the MTA has not justified the estimates of indirect costs, and some of these costs may be unnecessary. To be conservative, I have assumed that the indirect costs would be included and have applied the MTA's indirect-cost percentages from Exhibit B-1 to the labor costs used in my analysis, which do not reflect the labor to install unnecessary items. Like the MTA, I added an overhead allowance of 10 percent, and an additional 10 percent profit, even though some might think it would be excessive to allow the questionable indirect costs, along with overhead, in addition to profit.

Q. WHAT IS THE BOTTOM LINE CHANGE IN THE LINEAR PER-FOOT COST THAT RESULTS FROM YOUR ANALYSIS?

A. As I noted above, Exhibit JC-RWB-7 sets forth my adjustments to the MTA's Proposal as set forth in Exhibit B-1. As shown in Exhibit JC-RBW-7, I compute a *materials cost* of $28,251.78 per 1,000 linear feet, as compared to the MTA's total of $116,059.00 per 1,000 linear feet. I have itemized the "avoided" labor costs that result from the fact that there is no need to install the hardware and other items associated with an above-floor installation. Eliminating these avoided labor costs results in a total *labor cost* of $453.11 per hour (as compared to the MTA's cost of $581.10 per hour), or $26,990 per 1,000 linear feet.

The combination of labor and materials results in a total direct cost of $55,302.23, which equals $63,129.33 when indirect costs are added using the MTA's percentages. Adding a 10 percent overhead and 10 percent profit margin to the

total of direct and indirect costs sums to a total of cost of $75,754.80 per 1,000 linear feet, or $75.75 per linear foot.

By comparison, the MTA's proposal sums to $338,252.06 per 1,000 linear feet and $338.25 per linear foot.

VI. OTHER COST COMPONENTS OF THE MTA'S TOTAL COST

Q. HAVE YOU ASSESSED THE REASONABLENESS OF THE MTA'S COST ESTIMATES RELATED TO THE AVAILABLE SPACE IN VENT BUILDING 6?

A. No. The MTA has provided no basis whatsoever for its claim that the per foot cost of Vent Building 6 is $225 per square foot. In terms of the square footage of space available in Vent Building 6, the MTA states only that there is approximately 2,264 square feet ***available*** for occupancy by the Carriers and the Selected Vendor with System-related equipment. However, this does not mean that this space will actually be used or allocated to wireless facilities. The MTA does not provide the information needed to determine actual use or allocation. Therefore, the Department should treat this component by setting only a square footage price for space eventually used.

Q. HAVE YOU COME TO ANY SPECIFIC CONCLUSIONS REGARDING THE SQUARE FOOTAGE TOTAL THAT THE MTA USED FOR VENT BUILDING 6?

A. Yes. The MTA multiplies the per-square foot construction cost of Vent Building 6 by the 2,264 square feet of space currently available in the building,

for a total allocation to the Carriers of $509,400. However, this MTA square footage figure exceeds what is likely to be used. If the Department addresses square footage at all, I believe that a maximum figure for the Carriers' total actual space needed should be about 1400 sq.ft. (assuming that all carriers need the space, which may not be true). I calculate this number as follows: 300 sq.ft. per carrier for radio equipment space times 4 carriers equals 1200 sq.ft., plus 200 sq.ft. for the MIKOM DAS head-end equipment. Using the MTA's $225 per-square foot construction cost, this would reduce the costs associated with use of Vent Building 6 to approximately $315,000 as a maximum, on worst-case assumptions about all Carriers requiring all of that space.

Q. HAVE YOU COME TO ANY SPECIFIC CONCLUSIONS REGARDING THE MTA'S PROPOSAL FOR THE USE OF SPACE IN THE PRE-EXISTING UTILITY ROOMS?

A. Yes. The MTA claims that 11.25 square feet of floor space is needed in each of the 28 utility rooms. In fact the projected floor space for Verizon Wireless (for example) of 2 units @ 8"(D) x 6"(W) x 32"(H) & Fiber Splice box 19"W x 12"D x 12"(H) mounted above the 2 units would require 2 square feet. The MTA claims there is a "code-required buffer space" around the unit that must be accounted for. To my knowledge, there is no electrical code that requires a buffer space around a piece of electronic equipment, other than an actual electrical circuit breaker panel board Therefore the carriers should pay only for up to 2 square feet of space in each utility room.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes. With the exception noted above regarding the potential need for supplemental testimony, this concludes my testimony.

Exh. JC-RWB-3

Massachusetts Turnpike Authority
Request for Proposals
CA/T Wireless Project - Vendor RFP

Appendix D: Answers to Questions

August 22, 2002

This Appendix D: Answers to Questions relates to and is hereby made a part of the "Request for Proposals, Central Artery Tunnel Wireless Project" issued by the Massachusetts Turnpike Authority (the "Authority") on July 10, 2002, as amended by Addendum 1 dated August 14, 2002 (together with all figures, appendices, and schedules attached thereto, the "RFP"). Below are all written questions received by the Wednesday, August 7, 2002 deadline stated in the RFP, along with the Authority's answers. To the extent that the Authority's answers alter the intent or meaning of any part of the RFP, these written answers shall govern. To the extent that these answers are inconsistent with any oral answers given on the Central Artery Tunnel and Facility Tour, or at any other time, these written answers shall govern.

Questions are shown below numbered and in italics. The questions have been ordered by general topic and grouped together with similar questions. The questions are shown below as they were received, with only minor typographical corrections. The company asking each question is shown in brackets at the end of each question. The Authority's answers are located below each question or group of questions in plain text.

Questions were submitted by the following:

on behalf of:	*by:*
Andrew Corporation	Patrick Lau
AeroComm	Paul Sullivan
Atlantic Western Consulting, Inc.	David Lee
Fischbach & Moore	Robert Clinton
Maverick Construction	Michael Geraigery
NextG Networks, Inc.	Jeremy M. Joyce
Nextel Communications	Kelly Lang Baker
Radio Frequency Systems, Inc.	Richard Bogue

CA/T Tunnels and Facilities

Question 1. *Does the existing electrical system have a back up generating system? If so is this on all circuits within the tunnel? [Maverick Construction]*

Answer 1: See Sections II-B and -C, pages 6-8, of the RFP.

Question 2. *Who are the present Telco providers providing backhaul in the equipment room? [Maverick Construction]*

Answer 2: See Section II-B(1)(b) of the RFP.

Question 3. *Where is the present Demarc location for backhaul traffic and what is the distance to that location? [Maverick Construction]*

Answer 3: See Section II-B (1)(b), page 7, of the RFP. In addition, this information is available from the plans that may be requested from the Authority pursuant to Section I-C of the RFP.

Question 4. *At which Utility Room does the conduit from Vent Tower #6 enter into the first I-90 tunnel and what is the distance? [Maverick Construction]*

Answer 4: This information is available from the plans that may be requested from the Authority pursuant to Section I-C of the RFP.

Question 5. *Are there any floor plan drawings for Vent Tower #6 equipment room? [Maverick Construction]*

Answer 5: Yes. This information is available from the plans that may be requested from the Authority pursuant to Section I-C of the RFP.

Question 6. *Are there Estimated Traffic Counts Available? [Maverick Construction]*

Answer 6: Estimated traffic volumes will be provided as soon as they are available.

System Design

Question 7. *Page 6 through 9, General. In relation to power and load calculations, engineering and design assumptions, space requirements, antenna systems and related planning efforts, is there a baseline set of principle parties and their coverage needs that should be used to baseline the initial designs or should the response include provisioning the network for all wireless operators, public safety, paging, cellular, PCS, commercial radio (AM & FM broadcast) regardless of their planned participation? [NextG Networks, Inc.]*

Answer 7: See Section II-A, pages 4-5, of the RFP.

Question 8. *Is there a pre-existing design model for the system that will be used to validate the RFP designs?*

(a) If so, is the pre-existing design model available for review? [Atlantic Western Consulting, Inc.]

Answer 8: See Section II, page 4, and Section V, page 22, of the RFP.

Question 9. *Is there a preexisting RF design concept that the MTA is expecting the vendors to adhere to? If so, can this be made available? [Radio Frequency Systems, Inc.]*

Answer 9: See Section II, page 4, of the RFP.

Question 10. *Section IID/System Requirements – Antenna System on Page 8 of the RFP requires "an antenna system that minimizes installation of a multitude of single antennae for individual Carrier signals." Is the Authority aware of a system that accomplishes this requirement? [Nextel Communications, Inc.]*

Answer 10: Based on industry research of standard equipment used on similar systems, the Authority believes this requirement can be achieved.

Question 11. *What vent buildings are available for the CO? [Atlantic Western Consulting, Inc.]*

Answer 11: See Section II-B, page 6, and Appendix A, of the RFP.

Question 12. *Section II, B, Central Office Approach. What is the availability of a more centrally located site (such as Vent Building 5 or Vent Building 1)? If either of these locations are available, would they have the same resources as VB6 (such as AC power, conduit access, ventilation, etc.)? [Andrew Corporation]*

Answer 12: See Section II-B, page 6, and Appendix A, of the RFP.

Question 13. *Page 8 F. Redundancy. In a fiber optic based network, the redundancy option for the fiber component is possible but costly. Is redundancy a requirement on the fiber network as an initial design assumption? [NextG Networks, Inc.]*

Answer 13: See Section II-F, page 8, of the RFP.

Question 14. *What is the MTA's definition of a redundant RF system? Does this apply only to power? Does this apply to continued RF signal capabilities in case of amplifier failure? [Radio Frequency Systems, Inc.]*

Answer 14: See Section II-F, page 8, of the RFP.

Question 15. *Is the selected vendor required to determine each of the carriers space requirements for their cell site equipment? [Atlantic Western Consulting, Inc.]*

Answer 15: No.

Question 16. *Are the carriers planning to have more than one cell site through out the tunnel system? If so, how many? [Radio Frequency Systems, Inc.]*

Answer 16: See Sections I, II and III, of the RFP.

Question 17. *Can the leaky coax be run on the tunnel walls, below the ceiling?*
(a) If so, what restrictions, if any, apply? [Atlantic Western Consulting, Inc.]

Answer 17: The Authority is looking to the Selected Vendor to design a System that meets the requirements set forth in the RFP. The specific features of the System proposed by each Vendor will be considered in the Authority's evaluation of the Vendor submissions. See Section II for a discussion of any restrictions.

Question 18. *Are there any restrictions on antenna locations and/or coax/fiber runs/locations? [Atlantic Western Consulting, Inc.]*

Answer 18: See Section II-B, II-C, II-D, II-H and II-I, pages 6-9, of the RFP.

Question 19. *Can air plenums be used above and below for cable runs? [Atlantic Western Consulting, Inc.]*

Answer 19: Fiber optic cables may not be located in either the supply or exhaust ducts.

Question 20. *Are there any restrictions in using Coaxial/Radiating cable in terms of mounting and enclosures?*

(a) *Can radiating cable be mounted in the darken area above the wall tiles and ceiling?*

(b) *In tunnel areas where there is a suspended ceiling, can radiating cables (antennas) be mounted above the ceiling? What is the attenuation loss of this ceiling?*

(c) *Is there a limitation on the number of cables that can be run in the tunnel for distributed antenna purposes? [Radio Frequency Systems, Inc.]*

Answer 20: The Authority is looking to the Selected Vendor to design a System that meets the requirements set forth in the RFP. The specific features of the System proposed by each Vendor will be considered in the Authority's evaluation of the Vendor submissions. See Section II for a discussion of any restrictions.

Question 21. *Can spare ceiling raceways and block-outs be used to access ur's? [Fischbach & Moore]*

Answer 21: The Authority is looking to the Selected Vendor to design a System that meets the requirements set forth in the RFP. The specific features of the System proposed by each Vendor will be considered in the Authority's evaluation of the Vendor submissions.

Question 22. *Can antenna supports be attached to existing tunnel lighting supports prior to conditional turnover by C20B2 contractor? [Fischbach & Moore]*

Answer 22: The Authority is looking to the Selected Vendor to design a System that meets the requirements set forth in the RFP. The specific features of the System proposed by each Vendor will be considered in the Authority's evaluation of the Vendor submissions.

Question 23. *How far can we extend the envelope for mounting the Antennas near the Doors? [Maverick Construction]*

Answer 23: The Authority is looking to the Selected Vendor to design a System that meets the requirements set forth in the RFP. The specific features of the System proposed by each Vendor will be considered in the Authority's evaluation of the Vendor submissions. See Sections II-C and II-D, pages 7-8, of the RFP.

Question 24. *Are there any restrictions for running the cable across the ceiling in the tunnel? [Maverick Construction]*

Answer 24: The Authority prefers that cable not be mounted to ceiling panels but it is prepared to consider proposals that contemplate mounting cable to ceiling panels.

Question 25. *Can we attach to the existing unistrut to mount our antennas/run cable? [Maverick Construction]*

Answer 25: In general, yes, provided that the structural integrity is not compromised, however the Authority will consider proposals that do not provide for attachments to the existing unistrut.

Question 26. *Section II, C, 1, Facilities, discusses Utility Rooms and Cross Passages. Is it generally feasible to use the Cross Passages between tunnels to route cabling from a Utility Room to the radiating network located in lanes not adjacent to the Utility Room? [Andrew Corporation]*

Answer 26: The Authority is looking to the Selected Vendor to design a System that meets the requirements set forth in the RFP. The specific features of the System proposed by each Vendor will be considered in the Authority's evaluation of the Vendor submissions. See Section II-D, page 8, of the RFP.

Question 27. *Is there a specific type of sealant that you require for the Penetrations from the Utility Rooms to the tunnels? [Maverick Construction]*

Answer 27: Design, materials, means, and methods will be approved by the Authority after review. Generally acceptable waterpoof sealants are likely to be approved, but the Authority reserves the right to reject specific proposed materials if deemed unsuitable.

Question 28. *Page 9 H. Conduit. The RF output from an RF to Optical repeater may require "leaky coaxial" cable. Is it required that all cables, including RF be housed in conduit or are there exceptions allowed for the RF input/output cables? [NextG Networks, Inc.]*

Answer 28: It is the responsibility of the Selected Vendor to install the System in accordance with all applicable codes and standards.

Question 29. *Does cable/coax/fiber have to be in conduit or fire rated? [Atlantic Western Consulting, Inc.]*

Answer 29: It is the responsibility of the Selected Vendor to install the System in accordance with all applicable codes and standards. See Sections II-B, II-C, II-D, and II-H, pages 6-9, of the RFP.

Question 30. *Are you requiring conduit in Utility Rooms? [Maverick Construction]*

Answer 30: See Answer 29.

Question 31. *Do you want the cable to be installed in Conduit or can we free run? [Maverick Construction]*

Answer 31: See Answer 29.

Question 32. *Section IIB.c/System Requirements – Central Office Approach contemplates the use of outdoor equipment cabinets equipped with their own HVAC to house the main equipment in the event HVAC is necessary. Has the Authority identified any outside locations as alternative equipment areas? [Nextel Communications, Inc.]*

Answer 32: No.

Question 33. *Should the design include caging of areas for the vendors complete with electrical system or will they be obligated to build their own enclosure? [Maverick Construction]*

Answer 33: The Authority is looking to the Selected Vendor to design a System that meets the requirements set forth in the RFP. The specific features of the System proposed by each Vendor

will be considered in the Authority's evaluation of the Vendor submissions. See Section II-B, page 6, of the RFP.

Question 34. *Upon completion of the turn-up system, what will be required of the vendor as regards as-built plans and documents? [Atlantic Western Consulting, Inc.]*

Answer 34: As-built plans in hard copy and AutoCAD 2000 or an approved equivalent will be required upon completion of the System.

Public Safety, Authority, and AM/FM Uses

Question 35. *Page 2A. General Performance Criteria Ss 2), Re: Public Safety / Potential Authority Uses. In the event that Public Safety and other Authority uses are included, is it the intent that these services be pro-bono or should these entities be considered in similar fashion to the wireless network operators and responsible for paying their proportionate share of capital and operating expenses? [NextG Networks, Inc.]*

Question 36. *Who is to pay for the equipment and maintenance of the public safety system? [Radio Frequency Systems, Inc.]*

Answers 35 and 36: In the event that the Authority requests that some or all of the existing public safety two-way radio systems be carried on the System, the Selected Vendor will be responsible for all costs associated with the installation and maintenance of such systems.

Question 37. *What are the specific frequency requirements for the public safety system? [Radio Frequency Systems, Inc.]*

Answer 37: See Appendix B, of the RFP.

Question 38. *When will the Authority make a decision regarding whether it will request that "some or all of the existing public safety two-way radio systems be carried on the System" as contemplated under IIA2/System Requirements – General Performance Criteria? [Nextel Communications, Inc.]*

Answer 38: Prior to the execution of the Vendor Lease Agreement, the Authority will make its decision regarding the Selected Vendor's obligation to accommodate any public safety two-way radio systems on the System.

Question 39. *Will there be any communications system in place when the first phase of the CA/T project is open for traffic, but prior to the System contemplated by this RFP being operational? [Nextel Communications, Inc.]*

Answer 39: There will be CA/T Integrated Project Control System (IPCS) components in operation at the time of tunnel opening.

Question 40. *Are public safety RF communications expected to work over the same backbone of the carriers? Does vendor need to consider a dedicated, stand-alone backbone? [Radio Frequency Systems, Inc.]*

Answer 40: See Section II-A(2), page 4, of the RFP.

Question 41. *Page B-3 II. AM/FM Rebroadcast Radio. Including broadcast radio as a requirement to the RFP and understanding that there would be a capital outlay required to integrate this into the network, what assumptions should be made in relation to who would be responsible for the cost associated with the hardware and the proportionate maintenance fees associated with delivery of rebroadcast? Also, who would be responsible for obtaining approvals from each listed station and related regulatory approvals as required (i.e. FCC licensing)? [NextG Networks, Inc.]*

Answer 41: The RFP does not state any requirement that the Selected Vendor carry the AM/FM rebroadcast frequencies. The only related obligation is that the Selected Vendor's System not interfere with the delivery of rebroadcast. See Appendix B, Section III.

Question 42. *Since there is already a distributed antenna system for AM/FM radio coverage in some tunnels will this be available in all tunnels? Are these current AM/FM antenna systems operational? [Radio Frequency Systems, Inc.]*

Answer 42: The CA/T Projects IPCS System includes installation of an AM/FM Rebroadcast System throughout the tunnels. Currently, AM/FM rebroadcast is operating in the Ted Williams Tunnel.

Construction and Access

Question 43. *What are the access times (hours, days) for installation of the distributed antenna systems and electrical equipment? [Radio Frequency Systems, Inc.]*

Question 44. *Is there any work restricting hours I.E. 1:00 am – 5:00 am short work hours? [Maverick Construction]*

Question 45. *Ref. RFP Sec. B, Schedule, Commencement of Construction to Begin November 18, 2002. Tunnel I-90 will be open to traffic. What access restrictions will be in place i.e. hours of allowed work? [Fischbach & Moore]*

Answers 43, 44, and 45: Subject to emergencies and other contingencies, the Authority envisions that work may be performed only between 2100-0500 hours, seven days a week.

Question 46. *Active roadway construction will require lane restrictions. What restriction will be allowed and who will pay for traffic control plans, set-ups, state police details, etc. [Fischbach & Moore]*

Answer 46: As to roadway construction restrictions, see Answers 43-45. The Selected Vendor will be responsible for preparing a plan for Authority approval and paying for all traffic control, set-ups, state police details and any other related costs. Current costs for state police details are $32/hour. Current costs for Authority set-ups are $1200/set-up per eight hour shift.

Question 47. *What is the expected completion date for each of the tunnel phases for the wireless system? [Radio Frequency Systems, Inc.]*

Answer 47: The current schedule for CA/T Project completion milestones is as follows:

I-90/Fort Point Channel connection and ramp L – November 8, 2002
I-93 Northbound – December 10, 2002
Initial I93 Southbound – December 10, 2003

The CA/T Project has identified potential schedule exposure of up to six weeks after these dates. The Initial I-93 Southbound completion date is the date on which it is expected that all southbound traffic will travel underground. Work on the Dewey Square Tunnel area will continue until the Full I-93 Southbound completion milestone date, with detours and work-arounds anticipated in that time period. Some punchlist work and some final work will be completed after the tunnels are open to the public. While CA/T work and wireless installation will be coordinated, CA/T work will have priority.

In preparing price proposals, prospective Vendors should assume that access for installation of the System will not be provided until roadways are open to public traffic.

Question 48. *Will diesel vehicle be required for construction or will gasoline be approved? [Fischbach & Moore]*

Answer 48: All vehicles operated in the tunnels prior to those tunnels being open to general traffic shall be diesel powered. Gasoline powered vehicles shall only be allowed in tunnels considered to be open to general traffic. In either case, only vehicles whose engine operation is necessary to the performance of the work (i.e., power take-off) shall be allowed to idle. In no case shall stores of either fuel, beyond that of the vehicles standard tank, be allowed.

Question 49. *Will security be required when working in Vent Tower #6? [Maverick Construction]*

Answer 49: Any contractor working in an Authority tunnel facility is required to adhere to the Access Work Request program. This program is established to insure that schedule conflicts do not exist, that Authority personnel are available to provide access to the required areas and that the Operation Control Center is aware of all persons working in a particular area, in the event of an emergency.

Question 50. *Will MTA provide a construction staging area? [Maverick Construction]*

Answer 50: Vendor will be responsible for obtaining staging areas.

Inspection and Testing

Question 51. *Who will be doing the acceptance test on the system?*
(a) Is there a set of criteria available for review? [Atlantic Western Consulting, Inc.]

Answer 51: See Section II-A, page 4, and Section IV-C, page 15, of the RFP.

Question 52. *Is there a third party inspection/ is there a budget/ what will be the criteria? [Maverick Construction]*

Answer 52: See Section III-A(3) and (5), page 10. There is not yet a budget for the costs associated with the Owner Representative whose responsibilities will include inspection of the Selected Vendor's work; the Authority anticipates that the Selected Vendor will include in its budget a line item for these costs. Although the Authority has not yet developed specific inspection criteria, the Authority envisions that the primary criteria will be the System's consistency with the System Design Criteria set forth in the RFP, the Selected Vendor's proposal, and the terms set forth in the Vendor Lease Agreement.

Question 53. *What constitutes RF system level acceptance for this system? Who will do this work? [Radio Frequency Systems, Inc.]*

Answer 53: See Answer 51 above.

Question 54. *What constitutes an interference test? Will the vendor or an outside consultant do this work? [Radio Frequency Systems, Inc.]*

Answer 54: See Section II-A(3), (4) and 5, pages 4-5, and Section IV-C(2)(b), page 15, of the RFP.

Vendor Costs

Question 55. *If there is live traffic in the roadways during construction, who pays for the lane closures and police details?*

(a) If the vendor is responsible, what are the charges so they can be factored into the construction price? [Atlantic Western Consulting, Inc.]

Answer 55: See Answers 43-46, above.

Question 56. *What entity(s) does the Authority contemplate paying for the costs associated with the installation of the Authority's and Public Safety's installations (equipment and installation costs)? [Nextel Communications, Inc.]*

Answer 56: See Answers 35 and 36.

Question 57. *Will the Selected Vendor be penalized in the event that costs exceed the maximum costs as specified in the Vendor Lease Agreement? If so, what is the structure of the penalty? [Nextel Communications, Inc.]*

Answer 57: As noted in Section IV-C(4), page 16, each Vendor is required to provide in its submission a guaranteed maximum system price. The Authority expects the Selected Vendor to adhere to the maximum price specified in its proposal. Although there is no penalty, per se, to the extent that the Selected Vendor's costs exceed its guaranteed maximum system price, such overrun would not be the responsibility of the Authority or the Carriers, but rather would lie solely with the Selected Vendor.

Question 58. *Who is responsible for the cost of Police Details? [Maverick Construction]*

Answer 58: The Selected Vendor will bear any costs associated with Police Details.

Question 59. *Will permit costs be waived? [Maverick Construction]*

Answer 59: Other than the $250,000 Selected Vendor Payment discussed at Section III-A(14), page 11, of the RFP, and the Fee Deposit discussed at Section IV-D thereof, no other payment will be required from the Selected Vendor to the Authority. Accordingly, the Authority will not charge a fee for issuing any work permit in respect to the Selected Vendor's installation of the System in the Central Artery Tunnels or other CA/T Project facilities; however, all costs

associated with System construction, installation, operation, and maintenance, including, but not limited to, traffic control and police set-up costs, shall be borne by the Selected Vendor.

Question 60. *Is there an existing budget/ and or cap of the $50,000.00 fee? [Maverick Construction]*

Answer 60: There is no existing budget or cap for the Authority's fees in connection with the CA/T Wireless Project. See Section IV-D, page 21, regarding the Fee Deposit.

Question 61. *What costs will be incurred by the successful bidder to pay for the MTA's oversight of the project? [Atlantic Western Consulting, Inc.]*

Answer 61: See Sections III-A(5), page 10, and IV-D, page 21. See also Answer 52.

Question 62. *Section III, A, Item 5, Owner Representative, states that the Authority shall designate an Owner Representative to supervise the construction and operation of the system by the Selected Vendor and its contractors. Further clarification of this is required. Will this person be an employee of the Authority or is the Authority simple looking for a single point of contact from the Selected Vendor during the construction and operation of the system? If this person is an employee of the Authority, what Owner Representative costs are associated with this requirement (i.e. salary, worker's compensation, benefits, etc.)? [Andrew Corporation]*

Answer 62: The Authority has not yet decided whether the Owner Representative will be an employee of the Authority or a third party. In either event, the Selected Vendor will be responsible for any costs or expenses associated with the Owner Representative.

Contracting Issues

Question 63. *Will Union Contractors be required to complete the entire project and/or different segments of the project? [Atlantic Western Consulting, Inc.]*

Question 64. *Should the work be bid out using union labor rates and will union forces be required after the MTA takes ownership of the CA/T Tunnels? [Nextel Communications, Inc.]*

Question 65. *Are union contractors required? [Radio Frequency Systems, Inc.]*

Answers 63, 64, and 65: The Vendor Lease Agreement is not subject to the CA/T Project Labor Agreement. However, the Selected Vendor is responsible for complying with all applicable state and federal requirements, including, but not limited to, any applicable laws with respect to prevailing wage rates.

Question 66. *Are there any minority and/or quota requirements for installation work to be done in tunnels? [Radio Frequency Systems, Inc.]*

Question 67. *Section IV, C, 6a, Certification of Affirmative Action Compliance, refers to Appendix C, Executive Order 390. That order discusses goals for MWBE participation in state funded contracts. Although this project is not being funded by the State of Massachusetts, is the Authority specifying any goals for MWBE participation in this project? If so, what are those goals? [Andrew Corporation]*

Answers 66 and 67: Exhibit A to this Appendix D discusses further the Authority's position and expectations with respect to the participation of women and minority owned businesses. See also Appendix C and Schedule B of the RFP.

System Maintenance and Operations

Question 68. *Pursuant to the requirements of Section IIG/System Requirements – Operation and Maintenance, will the Selected Vendor have 24/7 access to the entire CA/T Tunnel? Will the Carriers have 24/7 access to the entire CA/T Tunnel? Will the access require an escort by Authority officials? If so, is there a fee involved? [Nextel Communications, Inc.]*

Answer 68: In general, regular maintenance can be scheduled from 2100-0500 hours. Emergency access protocol will be developed with the Selected Vendor. Authority staff will manage traffic control set ups and be present when access is required. Current costs for Authority set-ups are $1200/set-up per eight hour shift.

Question 69. *Section IIA/System Requirements – Preventative Maintenance Program on page 5 requires the Selected Vendor to propose a diagnostic and preventative maintenance program and further that such diagnostics "shall be automated to the extent practical." Is the Authority aware of such a system? [Nextel Communications, Inc.]*

Answer 69: See Section II-A(5) of the RFP.

Question 70. *What is a capital upgrade? Who will make the determination that a capital upgrade is required? Who will negotiate the price of a capital upgrade? [Radio Frequency Systems, Inc.]*

Answer 70: A capital upgrade is any expense which, under generally accepted accounting principles consistently applied, would be treated as a capital expenditure and not an operating expense. The Authority will make the determination that a capital upgrade is needed in consultation with the Selected Vendor. The Authority envisions that the Selected Vendor will negotiate the price of any capital upgrades, subject to Authority approval. See RFP Section III-A(6), page 10, of the RFP.

Question 71. *What chemicals will be used in high-pressure washers to clean the tunnels that may effect the cables, and/or antennas? [Radio Frequency Systems, Inc.]*

Answer 71: Materials currently used are Chemstation 502a and Chemstation 50922.

Question 72. *Reference No. 2 and 3 above [Questions 45 and 46 regarding hours of work and lane restrictions], what will the criteria be during the maintenance/lease agreement be. [Fischbach & Moore]*

Answer 72: See Answers 44, 45, and 68.

Maintenance Fee

Question 73. *Page 12 B. Carrier / vendor Maintenance Agreements Ss 2) Vendor costs and fees. Is the formula mentioned in this section been formulated and is it available for review? Would the MTA consider collecting from the project participants other fees requested of the successful vendor over and above this cost based on service and maintenance fees? Specifically, NextG Networks would propose that an RF Transport fee (plus the service and maintenance fee) be assessed to each participant based on a monthly recurring per node basis and paid directly or indirectly to NextG Networks Inc. Would other fee structures be considered in the RFP response? [NextG Networks, Inc.]*

Answer 73: The formula referenced in Section III-B of the RFP is not available for review at this time. With respect to any specific fees that the Selected Vendor may require from the Carriers, the term "Maintenance Fee" as used in the RFP should be construed in the broadest sense possible; it is not intended to limit any fees or expenses that the Selected Vendor would customarily charge the Carriers or that Carriers would otherwise bear or reasonably should bear in the ordinary course of System operation.

Question 74. *Will there be a cap on the carrier Maintenance Fee that will be charged by the Selected Vendor to the Carriers? [Kelly Lang Baker, Nextel Communications, Inc.]*

Answer 74: No, there will not be a cap.

Question 75. *The fourth paragraph on page 1 under IA/Introduction – The CA/T Wireless Project states: "Once the System is operational, the Carriers will be charged for their pro-rata share of System use, as such share is determined by the Authority." What method is the Authority intending to use to determine said "pro-rata share"? [Nextel Communications, Inc.]*

Answer 75: The Authority does not believe that this information is necessary for prospective Vendors to prepare their submissions. When the Authority commences the Carrier component of this RFP process, it will provide all necessary and relevant information to the prospective Carriers, including this formula.

Question 76. *Section III, B, Item 2, Vendor Costs and Fees, states that each Carrier shall be required to pay an annual fee for operation and maintenance of the System. Can the payment of these fees be scheduled to occur at more frequent intervals (e.g. quarterly, monthly, etc.)? [Andrew Corporation]*

Answer 76: The Authority would consider an alternative schedule for payment of Vendor costs and fees.

System Funding

Question 77. *Section III, A, Item 14, Selected Vendor Payment, state that $250,000 is due the authority upon delivery of a written Notice to Proceed (NTP) with System Construction. What is the expected timing of the NTP relative to execution of the Carrier Lease Agreements? Further, in Item 13, Contingency, if the Authority fails to sign Carrier Lease Agreements with Carriers willing to fund into the escrow, would it still be the Authority's intention to issue the NTP to the Selected Vendor, and would it also be the Authority's expectation of the Selected Vendor to proceed with System Construction at risk? [Andrew Corporation]*

Answer 77: It is the Authority's intent to issue the NTP following the execution of all lease agreements. If the Authority fails to sign Carrier Lease Agreements sufficient to fund the Selected Vendor's guaranteed maximum price, the Authority will not issue the NTP to the Selected Vendor, nor would it expect that the Selected Vendor would proceed with System construction at its own risk. See Section III-A(13), page 11, of the RFP.

Question 78. *Section III, A, Item 4, System Construction Funding, states that the Authority shall make periodic distributions (from the escrow fund) to the Selected Vendor on account of such costs upon 50%, 75%, and 100% completion of work for each phase. Will the Authority ensure via scheduling of Carrier pre-payments, negotiated in the Carrier Lease Agreements, that adequate funds will be available (from the escrow account) at the expected dates of the aforementioned milestones? Also, will a statement of the*

escrow fund balance be reported by the Authority to the Selected Vendor at periodic intervals so as to ensure that adequate funding exists or is likely to exist upon the expected milestone completion dates? [Andrew Corporation]

Answer 78: As discussed in Section III-A(4) of the RFP, initial System costs shall be funded by Carrier-prepayments. Given that Carriers will be required to deposit all required funds up-front, the Authority considers a statement of the escrow fund balance to the Selected Vendor unnecessary.

Agreement Structure and Term

Question 79. *Page 1 Introduction, Re: "Carrier Lease Agreements." Is there a current working copy or draft of the agreement in process and are the business terms outlined? As this relates to the composite recurring rates the wireless carriers would be responsible for paying to the MTA directly, understanding the proposed economics is essential. [NextG Networks, Inc.]*

Answer 79: A draft of the Carrier Lease Agreement is not available at this time. The Authority believes that information regarding the Carrier Lease Agreement beyond what is currently provided in the RFP is not necessary or relevant to prospective Vendors' preparation of their submissions.

Question 80. *Page 10 A. Vendor / Authority Lease Agreement. The RFP establishes the MTA as the Neutral Host provider. NextG Networks Inc. would typically respond to this type of application whereby we would request a lease(s) directly with MTA and design and integrate wireless operators into the network under a Network Services Agreement directly between NextG Networks and each principal requesting use of the network. Are the terms specified in the RFP static in the sense that only the MTA can establish agreements with the various operators or would alternative capitalization and recurring rate plans be considered? [NextG Networks, Inc.]*

Answer 80: Although the RFP allows prospective Vendors to propose alternative System designs, the Authority will not accept any proposals for alternative structures of the relationship between the Authority, the Vendor, and the Carriers. Thus, only the Authority can establish the agreements discussed in the RFP with the Vendor and Carriers.

Question 81. *Solicitation of Carriers interested in providing wireless service within the System is referenced under IA/Introduction – the CA/T Wireless Project. Will the Authority utilize an RFP process to solicit Carriers interested in providing wireless service within the System? If so, what is the expected release date of said RFP? If not what method(s) will the Authority utilize to solicit Carriers that may be interested in providing wireless services within the System? [Nextel Communications, Inc.]*

Answer 81: Yes. Following its preliminary designation of the Selected Vendor, the Authority will solicit Carriers interested in providing wireless telephone service within the System. See Section I-A, page 1, of the RFP.

Question 82. *Paragraph 12/Restrictions under section IIIA/Vendor Agreements – Vendor/Authority Lease Agreements states: "The selected Vendor shall not provide wireless service to customers, sublease any rights to use the System, assign its ownership or other rights in the system, or contract with third parties to allow them to use the System. The provision seemingly prohibits a wireless carriers who is contemplating providing coverage via the System from also being the Selected Vendor. Is this the intent of this provision? If not, what is the intent? [Nextel Communications, Inc.]*

Answer 82: Responses to the Vendor RFP from Carriers will be considered. See Section I-A, page 1 of the RFP. If a Carrier is designated as the Selected Vendor, that Carrier will not be prohibited from providing wireless service through a separately solicited Carrier Lease Agreement. The Vendor Lease Agreement will not, however, convey any right to provide wireless service.

Question 83. *Section 3A please explain the lease terms and costs associated i.e. how much space etc. etc.? [Maverick Construction]*

Answer 83: Section III-A of the RFP sets forth the terms and conditions to be reflected in the Vendor Lease Agreement, including costs and space to be leased to the Selected Vendor.

Question 84. *Page 11 A. Vendor / Authority Lease Agreement S. 8) Term. Would a proposal whereby the term could be extended to a minimum of 20 years (10 years with (2) 5 year automatic renewals) or a proposal where ownership of the network wouldn't revert back to the MTA be considered? [NextG Networks, Inc.]*

Answer 84: The Authority will not consider either of the suggestions set forth in Question 84. See Section III-A(8) and (16), pages 11-12, of the RFP.

Question 85. *Under Section IIIA. 10/Vendor/Authority Lease Agreement – Term, will the Authority consider any extensions beyond the 20 year time period? [Nextel Communications, Inc.]*

Answer 85: No, the Authority will not consider any extensions beyond the 20-year time period set forth in the RFP. See Section III-A(8), page 11, of the RFP.

Question 86. *Please confirm that the term of the lease is 20 years, if not please explain the renewable 5 year terms, and how they effect item 16 of Section 3A? [Maverick Construction]*

Answer 86: As stated in the RFP, the term of the Vendor Lease Agreement is ten (10) years. At the Authority's option, the Agreement may be renewed for two (2) additional five (5) year terms. See Section III-A(8), page 11, of the RFP.

Question 87. *What are the threshold of renewal and non-renewal of lease terms? [Maverick Construction]*

Answer 87: At the Authority's option, the Vendor Lease Agreement may be renewed for two (2) additional five (5) year terms. See Section III-A(8), page 11, of the RFP.

Question 88. *When will the Authority make a decision whether or not to expand the System to the Harbor, Prudential, and Central Artery North Area Tunnels as contemplated under IA/Introduction – the CA/T Wireless Project? [Nextel Communications, Inc.]*

Answer 88: There is currently no specific timeframe contemplated for this decision.

Question 89. *Will the selected vendor, upon or forfeiture of $50,000.00 retain the rights to construct and maintain a wireless system within CAT, in the event no "notice to proceed" is given? If so how long will those rights exist? [Maverick Construction]*

Answer 89: No. It is the Authority's intent that, in the event that the Authority does not issue a Notice to Proceed to the Selected Vendor, the Vendor Lease Agreement with that Vendor will terminate. See also Answer 77.

RFP Process, Extension

Question 90. *Page 23 B. Schedule. Proposal Submission Date – August 22, 2002. Can this be extended 30-60 days to allow for a comprehensive design and planning process to complete? [NextG Networks, Inc.]*

Question 91. *Due to the complexity of the tunnel project, and the level of completeness required on the RFP response, would the MTA consider granting a 60 day extension on the RFP due date? [Atlantic Western Consulting, Inc.]*

Question 92. *What is the likelihood that the RFP response due date of August 22, 2002 will be postponed? [Nextel Communications, Inc.]*

Question 93. *After the 31 July information session and Central Artery Tunnel tour, it became evident that due to the size, complexity and detail involved in supplying the MTA with a quality, cost effective proposal, the August 22, 2002 due date would not be to the Authority's advantage.*

(a) Would the MTA consider extending the due date 90 days, 60 days minimum? [Radio Frequency Systems, Inc.]

Question 94. *Due to the size of this project and the intricacies of forming strategic partnerships for the successful execution of this important project, Andrew Corporation respectfully requests an extension of the submittal schedule (Section V, B, Proposal Submittal Date) to September 20th. [Andrew Corporation]*

Question 95. *Can we have an extension? Our proposal will not be ready by August 22, 2002. [AeroComm]*

Answers 90, 91, 92, 93, 94, and 95: The Authority has agreed to extend the deadline for submission for Vendor proposals to September 12, 2002. See Addendum 1.

Question 96. *Can we receive a soft copy of the drawings? [Atlantic Western Consulting, Inc.]*

Answer 96: No; however, hard copies of the drawings are available for $500 upon request from the Authority. See Section I-C, page 3, of the RFP.

Question 97. *Will the bidders be allowed to view the work areas one more time before submitting the final bid? [Atlantic Western Consulting, Inc.]*

Answer 97: The Authority conducted a Central Artery Tunnel and Facility tour on July 31, 2002. This is the only tour that will be conducted prior to the submission deadline. See Section V-A(1), pages 22-23, of the RFP.

Question 98. *Section IV, D, Fee Deposit. What is the estimated time frame for return of the Fee Deposit to vendors not selected? [Andrew Corporation]*

Answer 98: The Authority will return Fee Deposits from unsuccessful Vendors as soon as practicable following the execution and delivery of the Vendor Lease Agreement. See Section IV-D, page 21, of the RFP.

Exhibit A

Civil Rights Requirements

(a) Authority Policies. The Selected Vendor shall not discriminate by segregation or otherwise against any employee or applicant for employment because of race, color, religious creed, national origin, ancestry, sex, sexual orientation, disability or veteran status and shall undertake specific affirmative action in those areas identified by the Authority, from time to time, where utilization of transition plans, reports, goals, and timetables are necessary to ensure equal opportunity and to overcome the effect of past discrimination against specific groups. The Selected Vendor agrees that in all matters related to the System, it will establish and develop civil rights policies and programs, consistent with those of the Authority, designed to prohibit discrimination, ensure equality of opportunity, and implement appropriate narrowly tailored affirmative action in all operations, particularly in the areas of employment and public access.

(b) Workforce Requirements. The Selected Vendor shall exercise reasonable, good faith efforts to employ a diverse workforce in all levels of its organization relating to the System and impose a diverse workforce requirement in all contracts with its subcontractors. The Selected Vendor shall submit to the Authority upon the Authority's request workforce profiles, providing information on the utilization of minority group members and women in the workforce working on the System. If required by the Authority, the Selected Vendor will establish goals, and where necessary, develop action plans and timetables to ensure the equitable employment of minority groups and women in all workforces at the System. Said goals shall be developed in consultation with the Authority's Office of Civil Rights and shall be based on census data measures of minority and female availability in specific trades, job groups, or employment categories. The Selected Vendor shall develop and disseminate a public policy statement prohibiting discrimination in all of its operations, including but not limited to employment and contracting on the basis of race, color, religious creed, national origin, ancestry, sex, sexual orientation, disability and veteran status.

(c) Affirmative Market Contracting. Consistent with the Authority's policy to further the goals of Executive Order 390, the Selected Vendor agrees that it will utilize good faith efforts to employ minority and women owned businesses under the Vendor Lease Agreement, and the Selected Vendor will maintain records illustrating that minority and women owned businesses have had an equal opportunity to participate in business relationships created in furtherance of the Vendor Lease Agreement, including but not limited to the areas of construction, design, and maintenance of the System. The Selected Vendor shall submit from time to time when requested in writing by the Authority, profiles of all firms that have been contracted and/or employed by the Selected Vendor with respect to the System, identifying those firms that are certified as minority and women owned businesses. The Selected Vendor will establish goals, and where consistent with the goals of Executive Order 390, develop action plans and timetables to ensure the equitable participation of minority and women owned businesses in its business relationships with respect to the System. If necessary, goals shall be developed in consultation with the Authority's Office of Civil Rights and shall be based upon determination of minority and women business availability in specific industries.

Exhibit JC-RWB-4

Cost of Armored Cable Installation Without Conduit

Information below based on information obtained from the following : 2001 RS Means, NECA Manual of Labor Units 2001-2002 and Vendor Quotations.

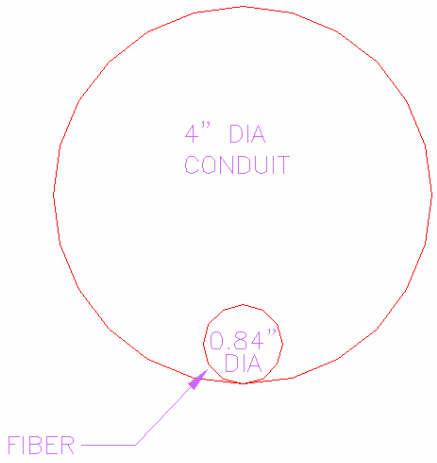
Material Description	Unit Price Material	Unit Price Labor*	Production Hours	Quantity	Ext Material Cost	Ext Labor Costs	Item Sub Total	Item Hour Sub Total
Armored Cable Install	7	59.56	0.065	1000	$7,000.00	$3,871.40	$10,871.40	65
SS Clamps 2 hole	3	59.56	0.16	150	$450.00	$1,429.44	$1,879.44	24
Anchors	1	59.56	0.2	300	$300.00	$3,573.60	$3,873.60	60
Pick up Truck	200			2	$400.00	$0.00	$400.00	0
Lift	320			0	$0.00	$0.00	$0.00	0
					$0.00	$0.00	$0.00	0
					$0.00	$0.00	$0.00	0
					$0.00	$0.00	$0.00	0
					$8,150.00	$8,874.44	$17,024.44	$149.00
				Direct Cost Per Linear ft			17.02	
*Rates based on original MTA cost estimate.								

RONALD W. BUIA, INC.
Electrical Engineers
Est. 1984

Exh. JC-RWB-5

Tunnel Fiber Optic Cable

R.W. BUIA
9-26-06



Area = $\pi r^2 = (3.1416)(2)^2$

$= 12.57$ in^2 cross sectional area

40% fill of conduit allowed

12.57 in^2 x 0.4 = 5.03 in^2

5.03 in^2 is the cross sectional area allowed for cables to be installed in a 3" diameter conduit.

The 432 strand fiber optic cable proposed by the wireless phone companies has a diameter of 0.84" (see attached sheet).

Area = $\pi r^2 = (3.1416)(0.42)^2$

$= .55$ in^2 cross sectional area

0.55in^2 is the cross sectional area of the proposed fiber optic cable.

0.55 in^2(area of cable) ÷ 5.03 in^2(40% of conduit area) x 100 = 10.93%

The fiber optic cable uses 10.93% of the allowable 40% fill space of the 3" conduit. This leaves 89.07% of the allowable cross sectional space for future cables.

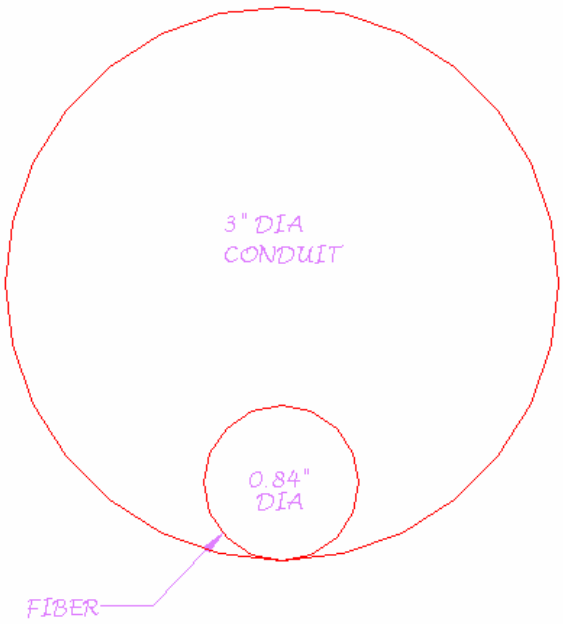
1600 Osgood Street, Building 20, Suite 2-89 ● North Andover, MA 01845
(978) 682-9229

RONALD W. BUIA, INC.
Electrical Engineers
Est. 1984

Exh. JC-RWB-6

Tunnel Fiber Optic Cable

R.W. BUIA
9-26-06



Area = πr^2 = (3.1416)(1.5) ^{2}

= 7.07 in^2 cross sectional area

40% fill of conduit allowed

7.07in^2 x 0.4 = 2.83in^2

2.83in^2 is the cross sectional area allowed for cables to be installed in a 3" diameter conduit.

The 432 strand fiber optic cable proposed by the wireless phone companies has a diameter of 0.84" (see attached sheet).

Area = πr^2 = (3.1416)(0.42) ^{2}

= .55 in^2 cross sectional area

0.55in^2 is the cross sectional area of the proposed fiber optic cable.

0.55 in^2(area of cable) ÷ 2.83in^2(40% of conduit area) x 100 = 19.43%

The fiber optic cable uses 19.43% of the allowable 40% fill space of the 3" conduit. This leaves 80.57% of the allowable cross sectional space for future cables.

1600 Osgood Street, Building 20, Suite 2-89 ● North Andover, MA 01845
(978) 682-9229

EXHIBIT JC-RWB-7
(Page 1 of 3)

Tunnel Conduit Cost Estimate MTA Proposal A31vs. Joint Carrier ("JC") Analysis							
Direct Material Costs:		MTA	JC		MTA	JC	JC Labor
Material Description Per JC	Material Description Per MTA	Unit Price	Unit Price	Quantity	Est. Cost	Est. Cost.	Per Hour
		Material	Material	per MTA			
* = material itself differs from MTA							
RGS 4" Conduit*	Conduit 4" AISI Type 316	$39.67	$17.05	1000	$39,665.71	$17,050.00	$308.00
4" 45º Bend	Elbow 4", 45º	$120.91	$77.50	6	$725.46	$465.00	$12.63
4" 22 1/2 Bend	Elbow 4", 22 1/2"	$60.46	$66.50	10	$604.55	$665.00	$21.05
Pull Box 32x12x8 NEMA 4	Pull Box 32x12x8, NEMA 4X Type 316	$4,972.00	$336.00	5	$24,860.00	$1,680.00	$100.00
Ground Hub 4" water tight	Water-tight 4" Grounding Hub	$264.08	$264.08	10	$2,640.81	$2,640.81	$11.43
Support Channels 1 5/8	Support Channel 1-5/8, Type 316	$14.94	N/A	300	$16,780.50	$0.00	$0.00
Anchors 1/2 - 2 1/2	Drilled-in Anchors 1/2"x2 1/2"	$3.49	N/A	400	$1,398.68	$0.00	$0.00
SS Clamps 2 Hole	SS Clamps, 2-hole with sprockets/washer	$55.94	N/A	200	$11,187.00	$0.00	$0.00
Exp/Deflection Fitting 4"	Expansion/Deflection Fitting 4"	$796.65	N/A	4	$3,186.60	$0.00	$0.00
Pick-Up	Equipment, Pickup/wk	$200.00	$200.00	29	$5,811.42	$5,811.42	$0.00
Lift	Equipment, Lift/wk	$320.00	N/A	29	$9,296.27	$0.00	$0.00
Total Material Costs					$116,157.00	$28,312.23	$453.11
Labor Costs (From Page 2)					$34,611.21	$26,990.00	
Materials & Labor Subtotal:					$150,768.21	$55,302.23	
Indirect Costs (From Page 3)					$10,037.25	$7,827.10	
Total Materials & Labor, Plus Indirect Costs					$160,805.46	$63,129.33	
SUMMARY:							
Total Direct (M&L) and Indirect					$160,805.46	$63,129.00	
Overhead = 10%				0	$16,080.55	$6,306.80	
Profit = 10%				0	$16,080.55	$6,306.80	
Traffic Set-ups and Police Details/day		$2,000.00	N/A	73	$145,285.50	$0.00	
GRAND TOTAL Per 1,000 Linear Feet:					$338,252.06	$75,742.60	
Price Per Foot Installed		$338.25	$75.74				

MTA Labor Costs Eliminated in JC Analysis		
	GM	Hourly
Support Channel	$2,376.33	39.900
Drilled-In Anchors	$2,548.05	42.800
SS Clamps	$1,905.03	32.000
Expansion/Deflection fitting	$794.02	13.232
Total	$7,623.43	127.932

Summary		
	Dollars	Per Hour
MTA Labor Cost	$34,611.21	$581.10
Less: Unnecessary Cost	($7,623.43)	($127.93)
JC Labor Cost	$26,987.78	$453.17
	$26,990.00	

EXHIBIT JC-RWB-7
(Page 3 of 3)

Indirect Costs: Recalculated with JC Estimated Labor Costs					
			Quantity	Labor	Total
	Temp Facilities Material = 0.5% Labor		0.005	$26,990	$134.95
	Temp Facilities labor = 0.5% Labor		0.005	$26,990	$134.95
	Construction Utilities Material = 0.5% L		0.005	$26,990	$134.95
	Construction Utilities Labor = 0.5% L		0.005	$26,990	$134.95
	Cleanup Labor = 1.0% Labor		0.01	$26,990	$269.90
	Material Handling Labor = 1.0% Labor		0.01	$26,990	$269.90
	Maintenance Labor = 1.0% Labor		0.01	$26,990	$269.90
	Survey Labor = 1.0% Labor		0.01	$26,990	$269.90
	Security labor = 1.0% Labor		0.01	$26,990	$269.90
	Weather Protection = 1.0% Labor		0.01	$26,990	$269.90
	Small Tools and Consumables = 3.0% L		0.03	$26,990	$809.70
	Misc Construction equipment = 3.0% L		0.03	$26,990	$809.70
	Field Supv and Eng. = 15.0% Labor		0.15	$26,990	$4,048.50
	TOTAL				**7827.10**

EXHIBIT JC-RWB-8

Conduit Cost Estimate

JC Estimate for 3" Galvanized Conduit vs. MTA Estimate for 4" Conduit

Information below based on information obtained from the following : 2001 RS Means, NECA Manual of Labor Units 2001-2002 and Vendor Quotations.

Material Description	Unit Price Material	Unit Price Labor*	Production Hours	Quantity	Ext Material Cost	Ext Labor Costs	Item Sub Total	Item Hour Sub Total
3" RGS Conduit	11.65	59.56	0.208	1000	$11,650.00	$12,388.48	$24,038.48	208
3" RGS 45' Bend	43.5	59.56	2.105	6	$261.00	$752.24	$1,013.24	12.63
3" RGS 22-1/2' Bend	43.5	59.56	2.105	10	$435.00	$1,253.74	$1,688.74	21.05
Pull Box 32x12x8	336	59.56	20	5	$1,680.00	$5,956.00	$7,636.00	100
Ground Hub 3" w/Tight	264.08	59.56	1.143	10	$2,640.80	$680.77	$3,321.57	11.43
Support Channels 15/8	0	59.56	0.133	0	$0.00	$0.00	$0.00	0
Anchors	0	59.56	0.107	0	$0.00	$0.00	$0.00	0
SS Clamps 2 hole	0	59.56	0.16	0	$0.00	$0.00	$0.00	0
Exp Deflection fitting	0	59.56	3.333	0	$0.00	$0.00	$0.00	0
Pick up Truck	200			29	$5,800.00	$0.00	$5,800.00	0
Lift	320			0	$0.00	$0.00	$0.00	0
					$0.00	$0.00	$0.00	0
					$0.00	$0.00	$0.00	0
					$0.00	$0.00	$0.00	0
Total					$22,466.80	$21,031.23	$43,498.03	$353.11

*Rates based on original MTA cost estimate.

Direct Cost Per Linear foot $43.50

					MTA Costs	JC Costs
Labor Costs (see above)					$34,611.21	$21,031.23
Directs Subtotal:					$150,768.21	$43,498.03
Indirect Costs (Page 2)					$10,037.25	$6,099.04
Total Indirect Plus Direct Costs					$160,805.46	$49,597.07
SUMMARY:						
Indirect plus Direct Costs					$160,805.46	$49,597.07
Overhead = 10%				0	$16,080.55	$4,959.71
Profit = 10%				0	$16,080.55	$4,959.71
Traffic Set-ups and Police Details/day		$2,000.00		73	$145,285.50	$0.00
					$338,252.06	$59,516.49
Price per foot installed					$338.25	$59.52

Indirect Costs: Recalculated with JC Labor Costs					
			Quantity	Labor	Total
	Temp Facilities Material = 0.5% Labor		0.005	$21,031.23	$105.16
	Temp Facilities labor = 0.5% Labor		0.005	$21,031.23	$105.16
	Construction Utilities Material = 0.5% L		0.005	$21,031.23	$105.16
	Construction Utilities Labor = 0.5% L		0.005	$21,031.23	$105.16
	Cleanup Labor = 1.0% Labor		0.01	$21,031.23	$210.31
	Material Handling Labor = 1.0% Labor		0.01	$21,031.23	$210.31
	Maintenance Labor = 1.0% Labor		0.01	$21,031.23	$210.31
	Survey Labor = 1.0% Labor		0.01	$21,031.23	$210.31
	Security labor = 1.0% Labor		0.01	$21,031.23	$210.31
	Weather Protection = 1.0% Labor		0.01	$21,031.23	$210.31
	Small Tools and Consumables = 3.0% L		0.03	$21,031.23	$630.93
	Misc Construction equipment = 3.0% L		0.03	$21,031.23	$630.93
	Field Supv and Eng. = 15.0% Labor		0.15	$21,031.23	$3,154.68
	TOTAL				**$6,099.04**