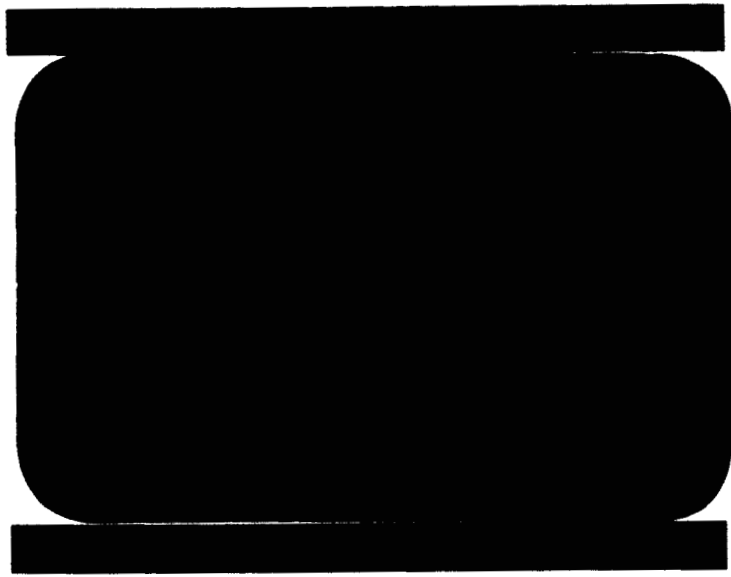


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Space Science Laboratory

VISIBILITY IN SPACE  
TARGET DESCRIPTION SUBROUTINE

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GENERAL DYNAMICS/CONVAIR

## FOREWORD

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ABSTRACT

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This report presents the description of a Computer Subroutine for use in calculating the visibility of the Lunar Excursion Module (LEM), Ascent Stage during the moon orbit rendezvous with the Command Service Module (CSM). The computer technique described here is however generally applicable with minor modification to the problem of spacecraft visibility. The subroutine makes use of bi-directional reflectance data for designated LEM materials to compute the illumination of the observer by LEM reflected light. The subroutine considers direct sunlight and both earth and moon reflected sunlight as sources of LEM illumination.

Geometric factor effects for the moon are treated by lunar surface mapping and use of the Lunar Reflectivity Model Tables (Ref. 3). The eclipsing of the sun and earth by the moon relative to LEM is considered.

SECTION 1  
INTRODUCTION

Computation of the illumination of an observer by a distant object in space is a complex function of the position and attitude of the object (target) in relation to the light sources, optical surface properties and geometry of the target, position of the observer and strength of the light sources. Problems of this type do not readily lend themselves to closed form solutions except where the nature of the physical effects and the geometry of the objects are treated in an extremely simplified fashion. However by application of numerical technique and the use of large scale digital computers, a program may be created to approximate the solution of such a problem to a high degree of accuracy. This report documents a significant subroutine of such a program and shows the relationship of this subroutine to the master program. In addition this report contains specific information for the LEM regarding geometry and bidirectional reflectivity of the LEM surface coatings used by the subroutine in the determination of target illuminance.

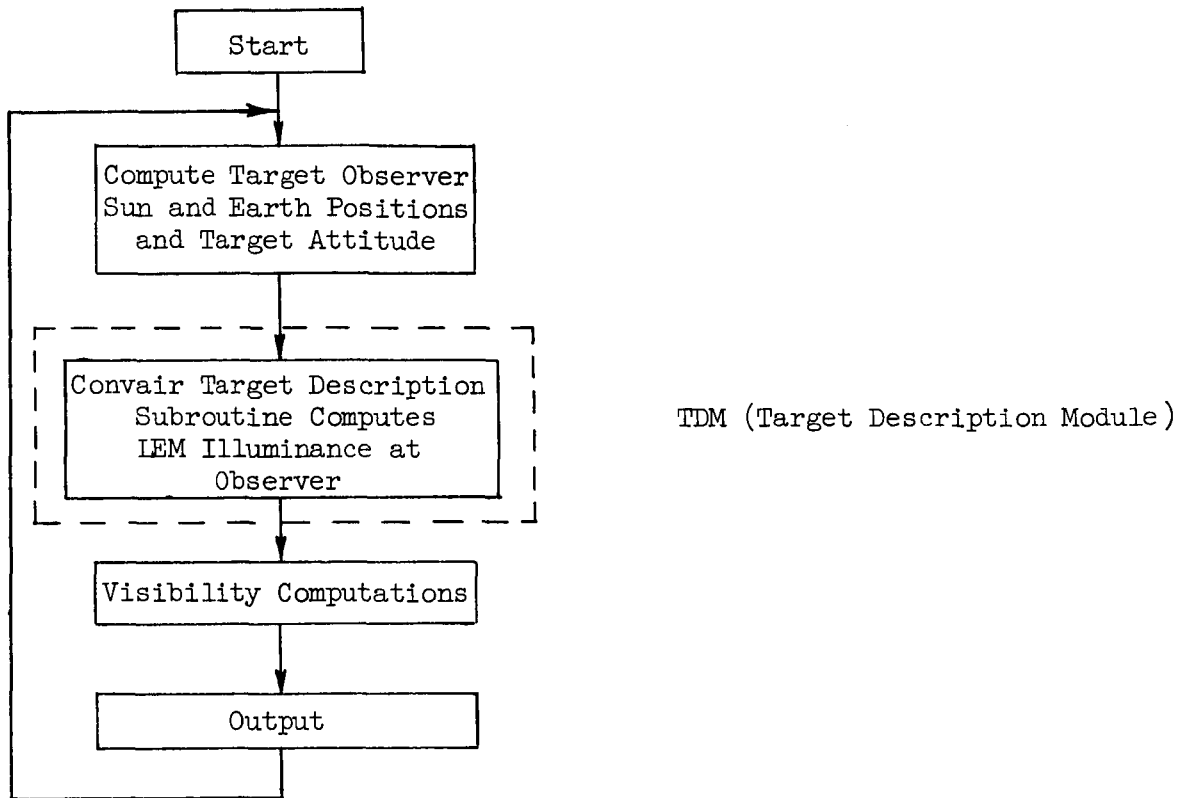


Figure 1. Conceptual Block Diagram of the LEM Visibility Program



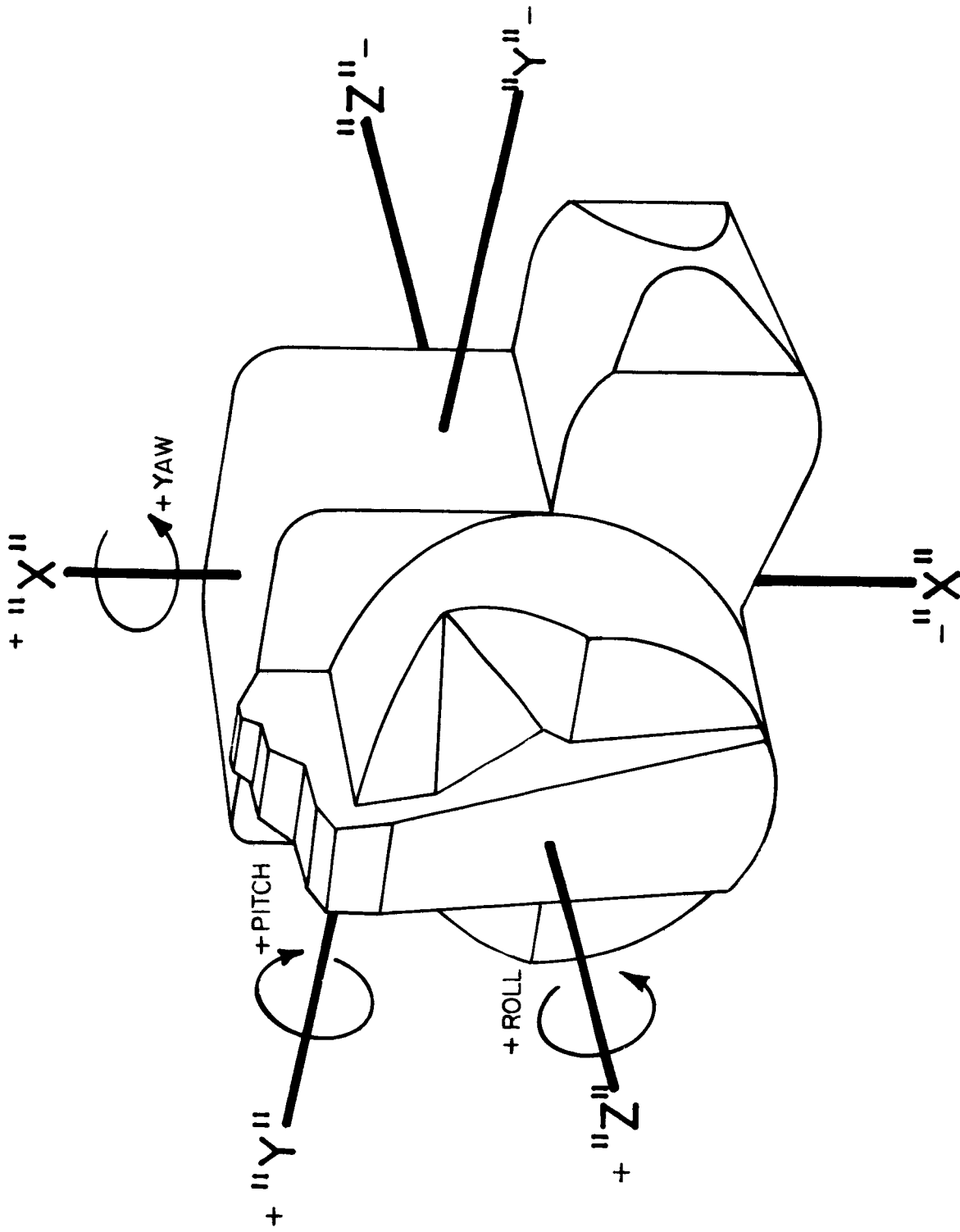


FIG. 2: LEM VEHICLE SHOWING ASCENT STAGE

SECTION 2  
DISCUSSION

2.1 DESCRIPTION OF THE PROBLEM. In order to establish the visibility of an object in space, it is necessary to determine the illuminance of the object at the observer and compare it to the illuminance of the background. This document describes a digital computer subroutine designed to solve by a numerical method the problem of the illuminance of an object under varying conditions of illuminance. This report is a continuation of the work of reference 6 and translates the general problem of radiant energy transfer between target and observer into a specific numeric procedure for computing the illuminance of the LEM spacecraft at the CSM spacecraft, preliminary to lunar orbit rendezvous. The TDM subroutine described here interfaces with the general program for computing target visibility in the manner shown in figure 1.

Other system interface information is shown in the annotated copy of the "Visibility Program Interface Descriptions" of Appendix A.

To summarize; when given the geometric location of the principle sources of visible light this program:

1. Examines the nature of the illumination of the LEM vehicle.
2. Making use of built-in information regarding the LEM vehicle geometry and bi-directional reflectance properties of the vehicle surface materials, the subroutine computes the reflected luminance available at the observer's position.

2.2 SUBROUTINE CONCEPT. The LEM vehicle ascent stage, figure 2, is mapped into many elemental surface areas by making use of the data provided in reference 7. This mapping was done outside of the program and forms a part of the basic data input. A discussion of this mapping is contained in Section 2.3 Vehicle Geometry. Surface elements fit two classes. Those which may be shadowed and those which cannot be shadowed. There is a distinction here between a surface which is shadowed and a surface which does not face the sun or the observer. On any vehicle, there will of course be many surfaces which do not face the observer or the sun depending on the orientation. The surfaces which are referred to as "shadowed" are surfaces which would ordinarily be illuminated by a source and/or seen by the observer were it not for another intervening (shadowing) surface. For the shadowable surfaces special computations are required and these are discussed in Section 2.8. In general, however, the required information concerning a planar surface element is its area and the direction cosines of the normal vector.

Consider now one of these elemental surface areas in relation to a source of light (figure 3). If the source is a point source then the illumination incident on the element is collimated and may be measured in light-watts/meter<sup>2</sup> on a surface normal to the source vector. A discussion of

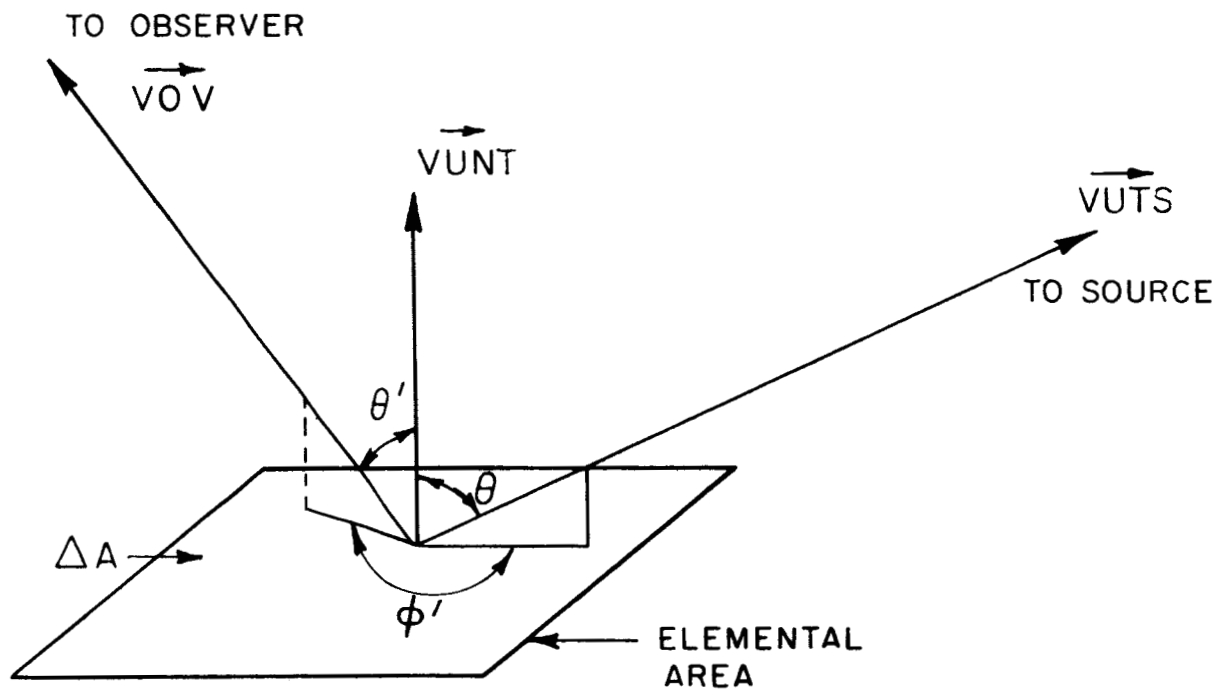


FIG. 3 : BI-DIRECTIONAL ANGLES FOR A LIGHT REFLECTING ELEMENT ON THE LEM SURFACE

the units of illumination is contained in Section 2.4. The luminous flux ( $F$ ) intercepted by the element is a product of the illumination ( $E$ ) and the projected area of the element for the source

$$F = E (\vec{V}_{UNT} \cdot \vec{V}_{UTS})(RAREA) \text{ lightwatts} \quad (1)$$

If the surface were perfectly diffuse and reflected all of the incident energy, then the luminous intensity leaving the surface along the normal would be

$$I_o = 1/\pi F \frac{\text{lightwatts}}{\text{steradian}} \quad \text{Ref. 5, page 257} \quad (2)$$

and in the direction  $\vec{V}_{UOV}$

$$I = 1/\pi F(\vec{V}_{UNT} \cdot \vec{V}_{UOV}) \quad (3)$$

If now one defines  $\rho$  as the ratio of intensity in direction  $\vec{V}_{UOV}$  of our particular material to that of a perfect-diffuse reflector in the same direction the intensity in direction  $\vec{V}_{UOV}$  would be;

$$I_{(\vec{V}_{UOV})} = 1/\pi \rho F(\vec{V}_{UNT} \cdot \vec{V}_{UOV}) \quad (4)$$

Assuming that the surface has no variation in bi-directional reflectance as a function of azimuthal angle from an arbitrary line in the surface to the projection of the source vector ( $\vec{V}_{UTS}$ ),  $\rho$  may be defined as a function of the three angles shown in figure 3

$$\rho = F(\theta, \theta', \phi')$$

The value of  $\rho$  is measured by the methods of reference 8 for LEM associated materials and is stored in tabular form as working data of the subroutine.

The value of illumination produced by the particular element under consideration at the position of the observer may now be computed. Substituting equation (1) into (4)

$$I_{(\vec{V}_{UOV})} = 1/\pi \rho E(\vec{V}_{UNT} \cdot \vec{V}_{UTS}) (\vec{V}_{UNT} \cdot \vec{V}_{UOV}) RAREA \quad (5)$$

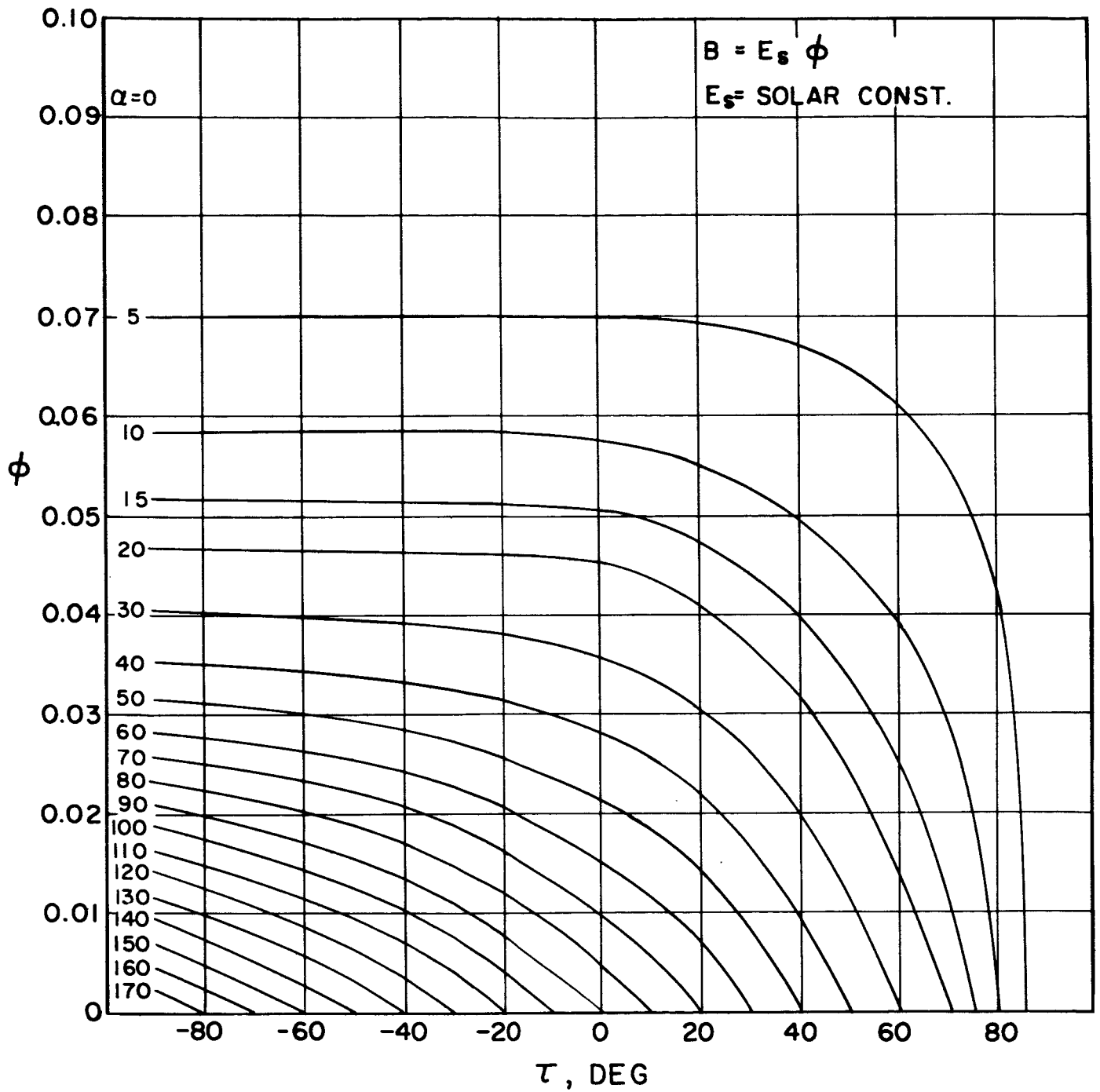


FIG. 4 : LUNAR PHOTOMETRIC FUNCTION

and since the illumination

$$E_{(OBS)} = I(\vec{VUOV})/D^2 \quad (6)$$

where D is the distance to the observer, then

$$E_{(OBS)} = 1/\pi \rho E(\vec{VUNT} \cdot \vec{VUTS})(\vec{VUNT} \cdot \vec{VUOV}) \frac{RAREA}{D^2} \quad (7)$$

This equation is used to compute the total illuminance at the observer by performing a summation over all vehicle elements which are illuminated and "see" the observer under the overriding condition of shadowing.

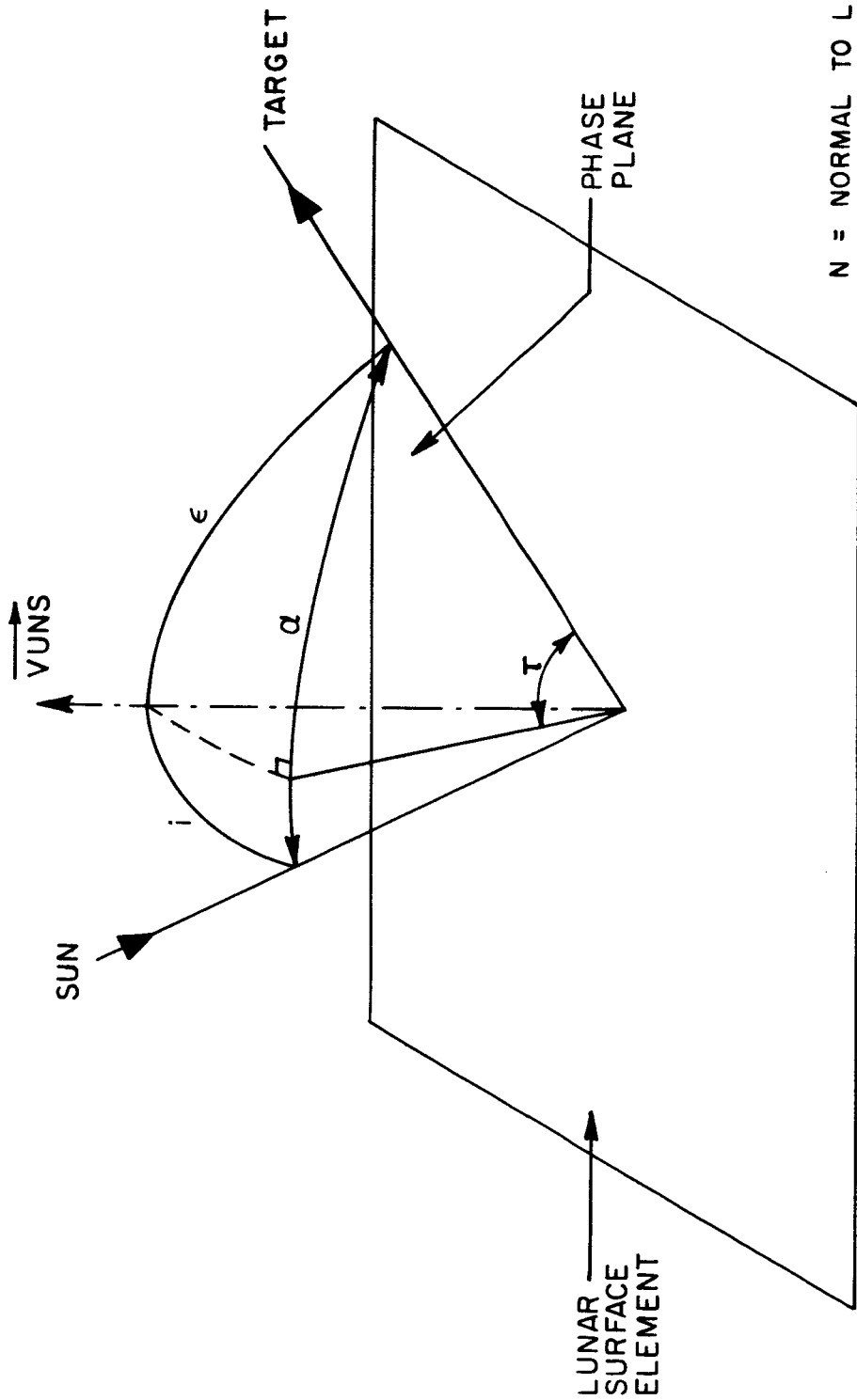
If, as discussed above, the source of illumination for the LEM were only a point source of known value, then the program concept would be complete. However, this is not the case. The lunar orbit rendezvous maneuver occurs in close proximity to the lunar surface (80 n.mi.). At this distance the bright moon background forms a widely distributed source of varying luminosity. In order to properly integrate the effect of this distributed source, the surface of the moon must be mapped into many elemental areas. Each area must meet the criteria of smallness compared to the distance to the target vehicle. P. Moon, reference 5, page 183 indicates that if the error in applying the inverse square law is to be less than 1%, the distance to the target should be at least five times the largest dimension of the surface source. In addition, the source intensity in the direction of the target must be known. To obtain this intensity the TDM subroutine described here makes use of the Lunar Reflectivity Model, reference 3.

The tabular data of figure 4 is used in linear double table look-up form to compute the photometric function  $\phi$ . The photometric function is then multiplied by the solar illumination  $E_s$  in lightwatts/meter<sup>2</sup> to yield a luminosity

$$B = E_s \phi(\alpha, \tau) \quad (8)$$

in the direction of the target vehicle. The illumination then at the target vehicle is

$$E = - \frac{E_s \phi A}{D^2} (\vec{VUNS} \cdot \vec{VUTS}) \quad (9)$$



- N = NORMAL TO LUNAR SURFACE ELEMENT
- i = ANGLE OF INCIDENCE
- $\epsilon$  = ANGLE OF EMITTANCE
- $\alpha$  = PHASE ANGLE
- $\tau$  = PROJECTION OF  $\epsilon$  ON PHASE PLANE

FIG. 5 : ANGLES ASSOCIATED WITH THE LUNAR PHOTOMETRIC FUNCTIONS

where  $D$  is the distance from a particular lunar surface element to the target vehicle and

$$- A (\vec{V}_{UN} \cdot \vec{V}_{UT})$$

is the projected area of that surface element in the direction of the target vehicle. The geometry of the angles involved in the photometric function are shown in figure 5.

When the sun is above the lunar horizon for the target vehicle (LEM), the TDM subroutine examines the illumination contributed by each of the moon surface elemental areas for each of the LEM surface elements under the condition of vehicle self shadowing.

In addition to lunar reflected sunlight the program considers the sun and earth reflected sunlight as sources. Both of these sources are treated as point sources obeying the inverse square law and the illumination is discussed in Section 2.4.

The program relates the geometry of the various sources by transformation matrices discussed in Section 2.7. All integration (summation) of illumination of the observer by reflected illumination from the target vehicle is performed in the vehicle system. The vehicle system is discussed in Section 2.6. The integrated illumination to the observer is presented in lumens/ft<sup>2</sup> as output of the program although all computations internal to the program are performed in lightwatts and meters.

2.3 VEHICLE GEOMETRY, LEM ASCENT STAGE. The LEM ascent stage of figure 2 was divided into 63 surface areas and 2409 elemental receiver areas as defined in Section 4.2. Each surface area is classed as shadowable or non-shadowable and a general description of its coating appearance is given in Table 1. Table 2 contains the necessary geometric information required by the TDM.

For non-shadowable planar surfaces, no subdivision of the surface into elemental areas is required. The information required by TDM and stored by the subroutine as data is:

1. The total surface area.
2. The direction cosines of the surface normal.

For an example of this type of surface, see surface 1 of Table I.

For shadowable planar surfaces, the surface must be finely divided into smaller areas in order to properly account for partial shadowing of the surface. A standard element size for this condition was chosen as .01 meters<sup>2</sup>. Where possible this dimension was used in defining an element



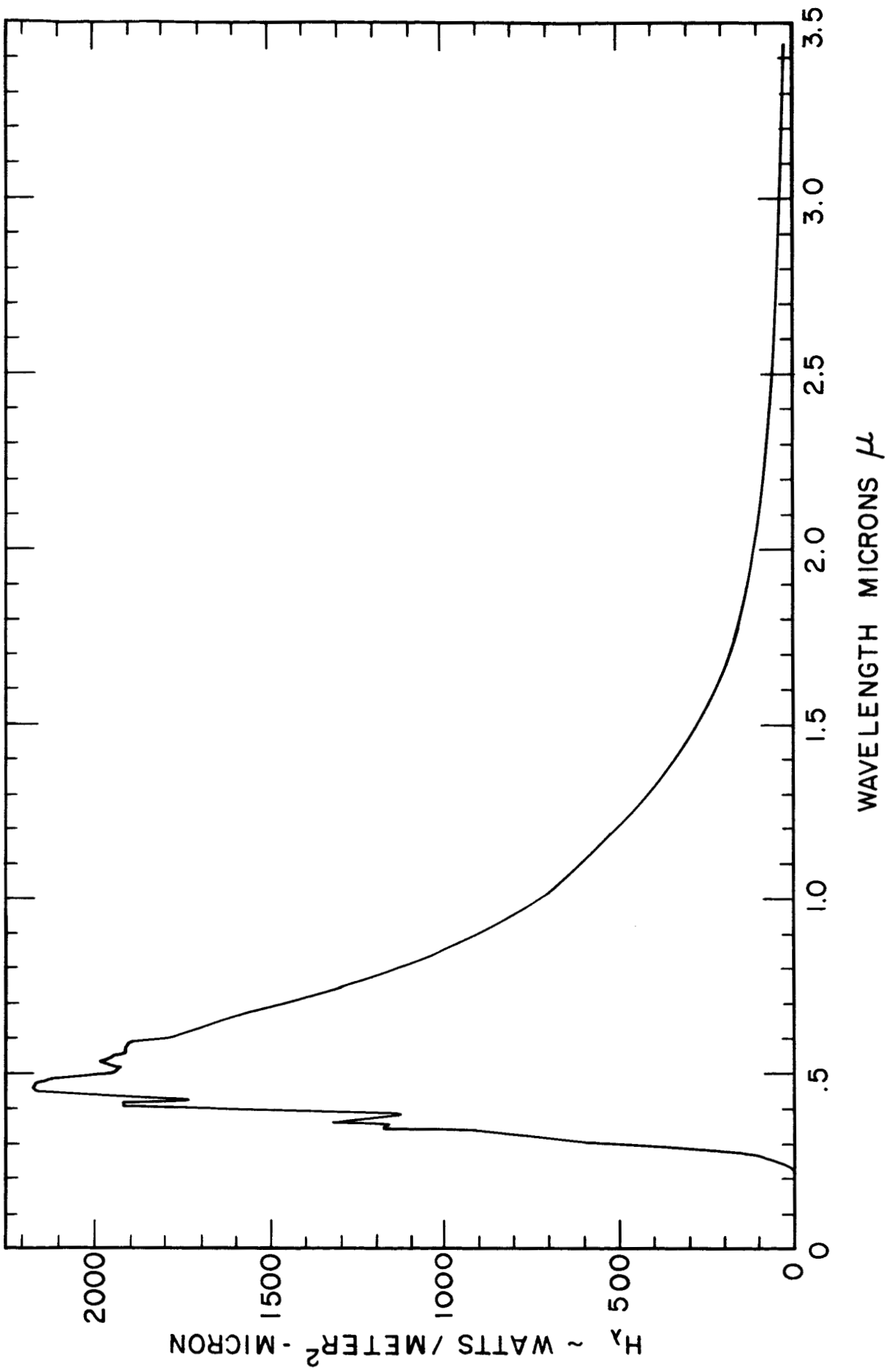


FIG. 6 : SOLAR RADIATION FUNCTION ( JOHNSON 1954 )

area. Table II gives the required data for this type element which is;

1. area,
2. direction cosines of normal, and
3. location of the element's center in the LEM vehicle coordinate system.

For an example of this type of surface, see surface 2 of Table 2.

All of the surfaces on the LEM are either planar or cylindrical. The first 58 surfaces in Table II are planar. Surfaces 59 through 63 are cylindrical. For the non-shadowable cylindrical surfaces, the surface elements are long narrow strips running the length of the cylinder. These elements are defined by;

1. area, and
2. direction cosines of normal.

For an example of this type of surface, see surface 59 of Table II.

When the surface is cylindrical and shadowable the surface elements are defined in the same manner as shadowed planar elements, except of course that the direction cosines of the elements vary around the circumference of the cylinder.

Another problem of geometry is the establishment of the shadowers. Data on shadowers is contained in Table III of Section 4.2. Each shadower is represented as a closed polygon defined by the coordinates of the vertices in the LEM vehicle system. All of the points of the shadower must lie within a common plane. The adjacent sides of the polygon must form an angle less than  $180^\circ$  when measured from within the polygon (i.e., the polygon is convex). Shadowers of this type form in effect a silhouette of the solid object shadowing another surface when viewed from the shadowed surface. A full understanding of shadower definition is best obtained by use of a three dimensional model of the vehicle. The mathematical technique involved in shadowing computation is discussed in Section 2.8.

2.4 LIGHT SOURCES. The primary source of all visible energy treated in this program is the sun. The energy emitted by the sun has the spectral characteristics of figure 6 at the mean earth-sun distance and varies with distance from the sun by the inverse square law. The TDM subroutine assumes that the spectral nature of the visible light (.38 - .76  $\mu$ ) is unchanged by reflection from the earth or the moon so that all light arriving at the target (LEM) has the same spectral signature. Illumination from a continuous light source such as the sun may be computed by

$$E = \int_0^{\infty} v_{\lambda} H_{\lambda} d_{\lambda} \quad (10)a$$

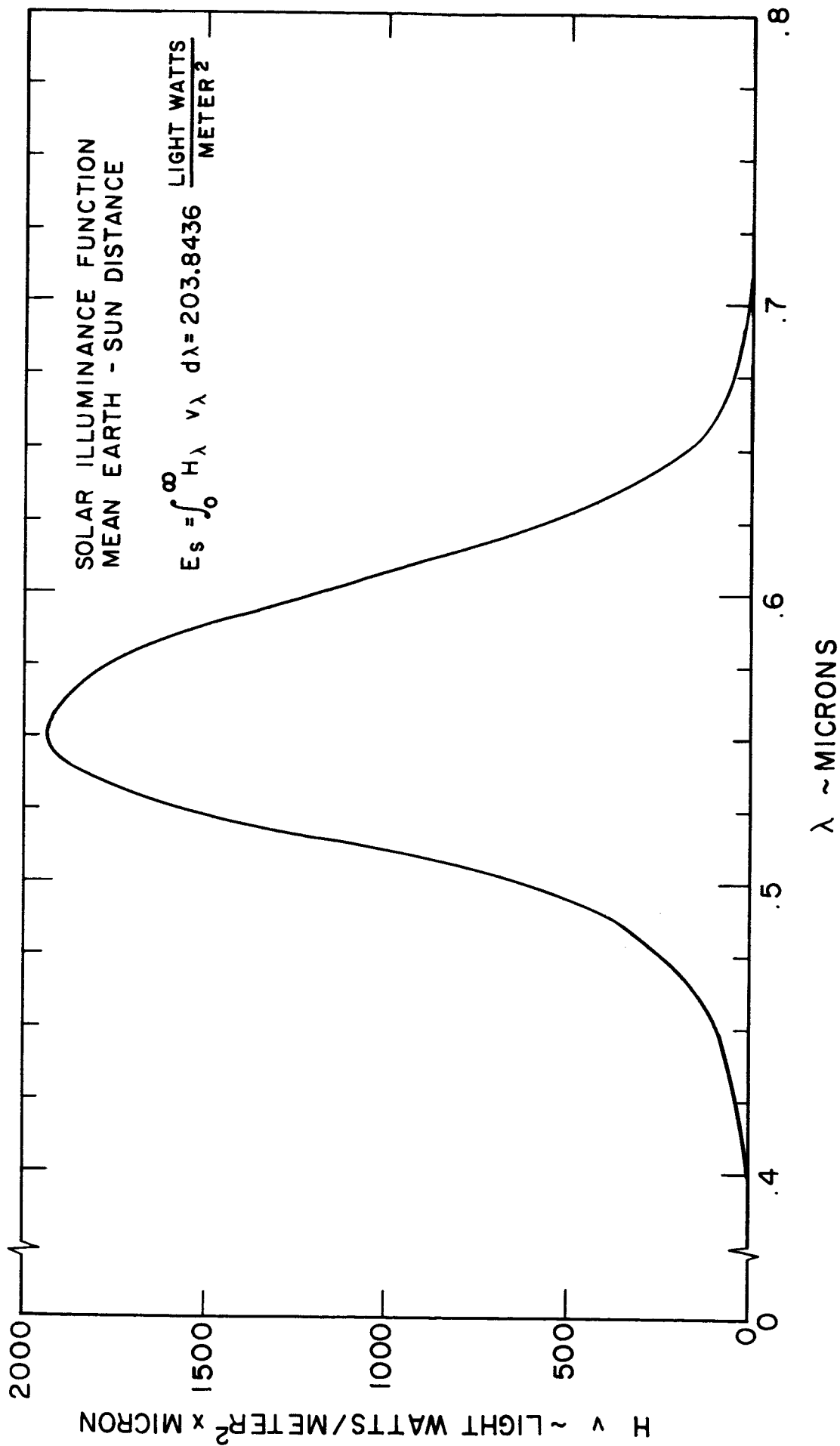


FIG. 7 : SOLAR ILLUMINANCE FUNCTION

where  $V_\lambda$  is the standard visibility function (JUDD, Bu Stds J. R., 6, 1931, p 465).

The product  $V_\lambda H_\lambda$  is plotted as a function of  $\lambda$  to produce the solar illuminance function of figure 7. When the units of irradiation are those given by figure 6 the units of  $V_\lambda H_\lambda$  are lightwatts/meter<sup>2</sup> × micron. When the curve of figure 7 is integrated over all wavelengths, the resulting illumination at the mean earth-sun distance is

$$E_s = \int_0^\infty V_\lambda H_\lambda d_\lambda = 203.8 \frac{\text{lightwatts}}{\text{meter}^2} \quad (10)b$$

Because the distance to the sun varies with the time of year and since the moon-sun distance is supplied by the visibility program,  $E_s$  is computed by the inverse square law as a function of SPOS

$$E_s = 4.566932 \times 10^{24} / |\vec{SPOS}|^2 \quad (11)$$

where  $E_s$  is expressed in lightwatts/meter<sup>2</sup> and  $|\vec{SPOS}|$  (distance to the sun) is expressed in meters. An error of less than 0.3% is introduced by the assumption that the distances from the target, the earth, and the moon to the sun are all the same. For this reason, equation 11 is the only one used by the program for the computation of solar illumination.

The TDM subroutine computes earth reflected illuminance by the approximation formula given in reference 2 where  $h \gg R$

$$E = \frac{2aE_s}{3} \frac{R^2}{(R+h)^2} \frac{[\sin \phi + (\Pi - \phi) \cos \phi]}{\Pi} \quad (12)$$

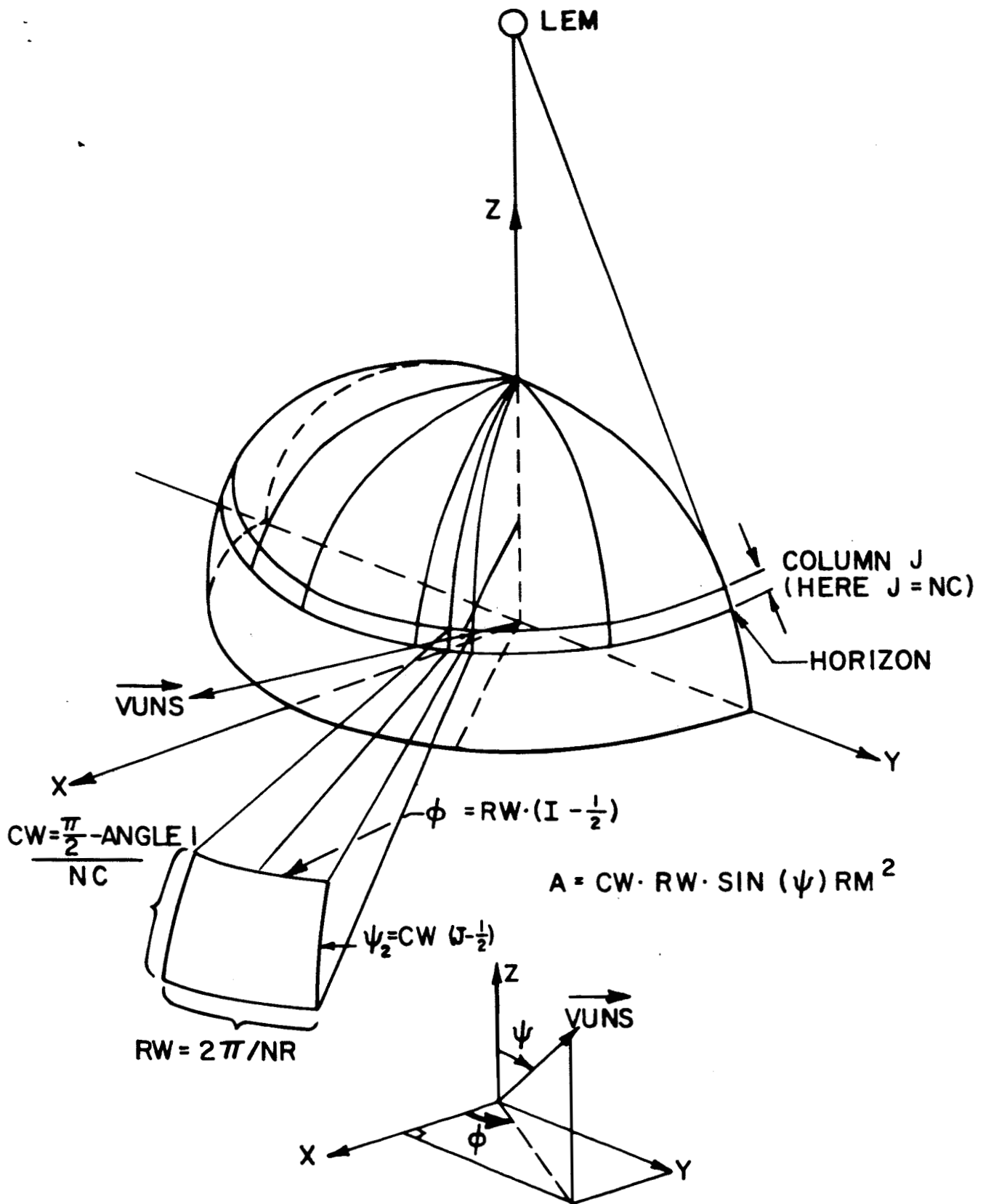
where  $a$  = the earth albedo  $\approx .4$

$E_s$  = the solar illuminance  $\approx 203.8 \frac{\text{lightwatts}}{\text{meter}^2}$

$R$  = the radius of the earth

$h$  = altitude above earth surface

$\phi$  = the phase angle



NOTE : THE ROW COUNT STARTS AT THE X-Z PLANE & PROGRESSES AROUND THE Z AXIS IN THE DIRECTION OF + φ. THE COLUMN COUNT STARTS AT THE Z POLE AND PROGRESSES TOWARD THE X-Y PLANE IN THE DIRECTION OF + ψ.

FIG. 8 : LUNAR SURFACE MAPPING

Computation of lunar reflected light has already been discussed in Section 2.2 Program Concept. For the geometric situation in which the sun is above the lunar horizon, the surface of the moon is mapped into many elements. (The TDM uses 400 for an 80 n. mi. orbit.) The geometry of this mapping about a point on the surface of the moon directly below the vehicle is shown in figure 7. Sunlight is reflected from each of these elements in a manner defined by the Lunar Reflectivity Model, figure 4; see also Ref. 3. This model, so far as the TDM subroutine is concerned, consists of a double linear table look-up with the angles  $\alpha$  and  $\tau$  as defined by figure 5 as independent variables. Having established that the sun is above the horizon for the IEM, the subroutine computes the angles  $\alpha$  and  $\tau$  for each element and looks up the corresponding value of  $\phi$ . Each element is now treated as an additional source of light.

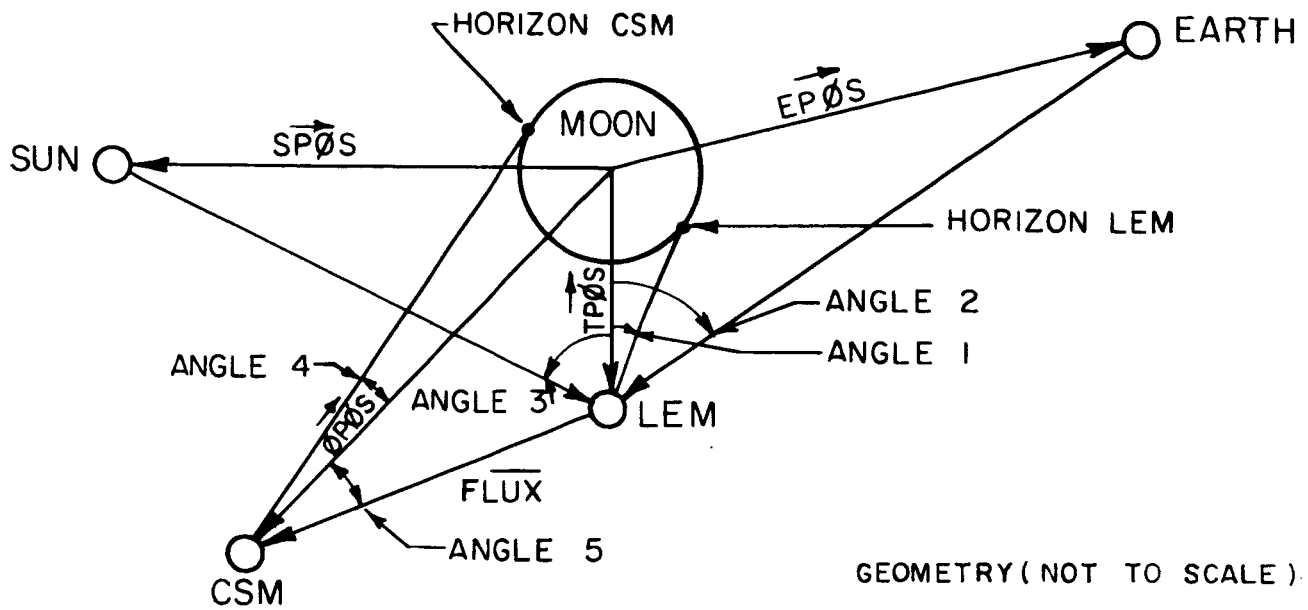


FIG. 9 : GEOMETRY INVOLVED IN COMPUTING ECLIPSING ANGLES

2.5 ECLIPSING. Any computation of illumination in the near vicinity of the moon must account for the possibility that on occasion one or more sources may be behind the moon relative to the target vehicle. For this reason special logic has been included in the TDM subroutine to account for the moon as an eclipsing body. All other conditions of eclipsing, i.e., the sun by the earth, are disregarded. For various positions of the LEM target vehicle and the CSM observer vehicle with respect to the moon, sun, earth, the following conditions of lunar eclipsing are treated.

For the LEM:

1. Sun eclipsed by moon (Lunar nite).
2. Earth eclipsed by moon (Dark or Earth).

For the CSM:

1. LEM eclipsed by moon (LEM below horizon).

The condition of eclipsing is computed by the simple expedient of comparing the angles from source to the lunar center (origin) with the angle to the horizon (see figure 9). If the sun is below the horizon for the LEM, there is no illumination from the sun or the moon (albedo). If the earth is below the lunar horizon, earth light energy is not computed. If the LEM is below the lunar horizon for an observer in the CSM, then no visibility can occur.



2.6 COORDINATE SYSTEMS. Three coordinate systems of reference are used by the TDM subroutine. These are:

1. The selenocentric system, which is defined by the Interface Description document of Appendix A.
2. The vehicle system, which is defined by the LEM drawings of reference 7 (see figure 2).
3. The sub-vehicle point system, which is defined by the following:
  - a. The "z" axis points in the direction of LEM.
  - b. The "y" axis is chosen in the "xy" plane of the selenocentric system.
  - c. The "x" axis completes a right handed system.
  - d. The system has a common origin with the selenocentric system.

Each coordinate system is related to the others by the transformation matrices discussed in Section 2.7. All trajectory data is supplied to the TDM subroutine in the selenocentric system. All computations of observer illuminance are performed in the LEM vehicle system. The lunar surface mapping is done in the sub-vehicle point system.

2.7 MATRIX TRANSFORMATION. Two matrix transformations are used by the TDM subroutine. These are:

1. Attitude Matrix - which transforms points or vectors between the LEM vehicle system and the selenocentric system.
2. Sub-Vehicle Matrix - which transforms points or vectors between the selenocentric system and the sub-vehicle point system.

The transform of the attitude matrix is defined by rotations about the principle axes of the LEM vehicle relative to the principle axes of the selenocentric system. These rotations are provided for TDM by the trajectory section of the visibility program and are:

$TATT_{(1)}$  = rotation about LEM "x" axis = yaw (y)

$TATT_{(2)}$  = rotation about LEM "y" axis = pitch (p)

$TATT_{(3)}$  = rotation about LEM "z" axis = roll (r)

(See Figure 2.)

The order of rotation is defined in that order: Yaw, pitch, roll and positive rotation is defined in the same sense for each axis as a right handed screw:

1. Positive yaw = nose left
2. Positive pitch = nose up
3. Positive roll = left side up

The z axis points toward the nose. Observing these definitions

$$TRS(M_{ATT}) = \left[ \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos y & -\sin y \\ 0 & \sin y & \cos y \end{pmatrix} \begin{pmatrix} \cos p & 0 & \sin p \\ 0 & 1 & 0 \\ -\sin p & 0 & \cos p \end{pmatrix} \right] \begin{pmatrix} \cos r & -\sin r & 0 \\ \sin r & \cos r & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

The sub-vehicle matrix is defined by the temporal position of LEM as provided to TDM by the trajectory portion of the visibility program. The only pertinent direction is that TPOS in the selenocentric system defines the direction of the "z" axis in the sub-vehicle point system. The matrix transform follows easily if the y axis is arbitrarily chosen to lie in the selenocentric "xy" plane and the x axis completes a right handed system  $\vec{VZSV} = \text{UNIT}(\text{TPOS})$

$$M_{\text{SVP}} = \begin{bmatrix} - & - & - \\ - & - & 0 \\ \vec{VZSV}_{(1)} & \vec{VZSV}_{(2)} & \vec{VZSV}_{(3)} \end{bmatrix}$$

For the attitude matrix post multiplication by a column vector representing a point in the selenocentric system yields a point in the vehicle system. For the sub-vehicle matrix post multiplication by a column vector representing a point in the selenocentric system yields a point in the sub-vehicle system. Both matrices are orthonormal transforms where the transposed matrix is the inverse transform.

2.8 TECHNIQUE FOR SHADOWING COMPUTATIONS. In the initial consideration of the computation of the reflected light from the LEM vehicle, it was assumed that the vehicle shape was convex. That is, it did not have external surfaces which would be "shadowed" by the other surfaces. There is a distinction here between a surface which is shadowed and a surface which does not face the sun or the observer. On any vehicle, there will of course be many surfaces which do not face the observer or the sun depending on the orientation. The surfaces which are referred to as "shadowed" are surfaces which would ordinarily be illuminated by the sun and seen by the observer were it not for another intervening (shadowing) surface. Actually, most space vehicles are "convex." It was found upon obtaining detailed data giving the actual shape of the LEM (drawings and a model) that the vehicle was by no means "convex" but had many surfaces which were capable of being shadowed. This situation considerably complicates the reflected light computation.

For a convex vehicle as the LEM was assumed to be, it is only necessary to establish the direction cosines and the area of each flat surface and to divide curved surfaces into a sufficient number of flat areas to approximate the curved surface, the criteria for the flat plates being established in reference 6. This data, together with the direction of the observer and the source (and the directional reflectance properties of the surfaces) would allow computation of the reflected light in a fairly straightforward manner. The positioning of one surface relative to another surface was not required in this scheme. The situation might be envisioned as a series of flat plates at a specified angle, each one being considered separately and its relation to others not considered.

If shadowing is considered, however, this picture is altered. It is necessary to establish the relationship of one surface to another if shadowing is possible. The method used by TDM to handle the shadowing problem is as follows:

1. The surfaces of the vehicle was "mapped" just as initially planned. The direction cosines and the area of each surface were tabulated. The curved surfaces were divided into many flat surfaces and tabulated along with the other surfaces.
2. By inspection of the vehicle drawings and of the vehicle model, the surfaces that cannot be shadowed were established and treated just as initially planned. Some of the surfaces of the LEM vehicle cannot be shadowed.
3. The surfaces which can be shadowed or cause shadows were then determined and tabulated (if a surface can cause a shadow, it can also be shadowed).
4. The surfaces which can be shadowed were divided into many small areas (square, rectangular, triangular or hexagonal; usually square but in some cases rectangular). The area of each of these little areas was determined and the coordinates of the center point of each small area was tabulated.

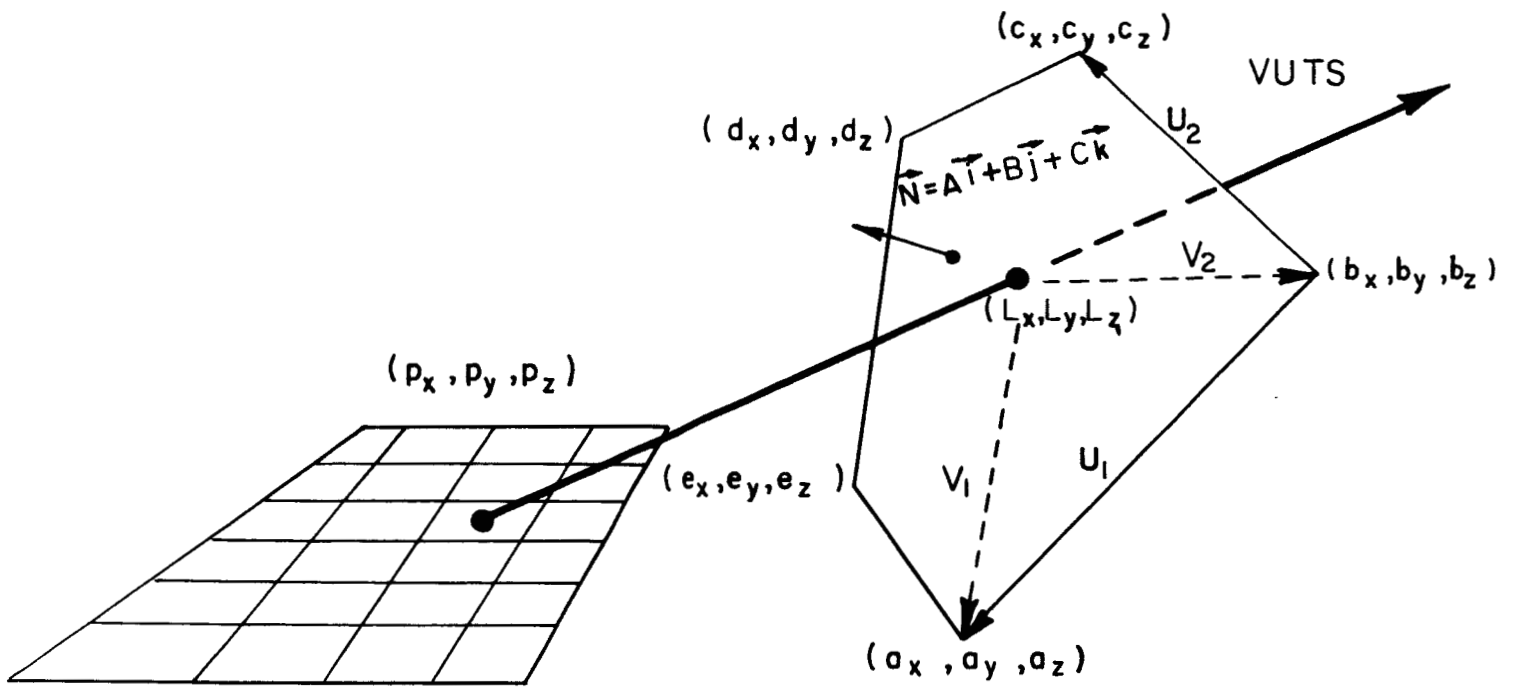


FIG. 10 : SHADOWING GEOMETRY

5. For each surface that is capable of causing shadowing the point at which the line enclosing the surface changes direction (i.e., corners) is designated by a point and the coordinates of these points were tabulated. (See Figure 10)
6. Lines are extended from the determined center point of each potentially shadowed area to the source and the observer. The points of intersection of these lines (source and observer vectors) with the plane containing the shadowing surface (i.e., plane through three "corner" points) are calculated. It is then determined whether or not these points lie within or outside the shadowing surface. If the point (intersection with the source or observer vector) lies within the shadowing surface, the area in question is shadowed. If neither point lies within the shadowing surface, the area is considered illuminated.

Application of this procedure to all shadowed surfaces allows determination of the extent of shadowing. In the program, illuminated surfaces (surfaces receiving light from the source and "visible" to the observer) will be treated as an ordinary unshadowed surface and shadowed surfaces will be considered black.

MATHEMATICAL TREATMENT. The mathematical treatment of the problem is as follows: Consider the schematic representation given in figure 10. The shadowed surface is divided into a number of small areas, the surface causing the shadow has given the coordinates of the corners. The equations of the lines from the shadowed surface to the observer and the source may be determined by substituting the coordinates of the center point of an element ( $p_x, p_y, p_z$ ) and the direction cosines of  $\vec{VUTS}$  or  $\vec{VUOV}$  into the following equations, considering the  $\vec{VUTS}$  vector only, one obtains

$$\frac{x - p_x}{VUTS_{(1)}} = \frac{y - p_y}{VUTS_{(2)}} = \frac{z - p_z}{VUTS_{(3)}} \quad (13)$$

This may be written as pairs of equations in x, y, and z of the following form:

$$x = m_1 y + c_1 \quad (14)$$

$$z = m_2 y + c_2 \quad (15)$$

where

$$m_1 = \frac{\vec{v}_{UTS}(1)}{\vec{v}_{UTS}(2)}, \quad c_1 = p_x - p_y m_1$$

$$m_2 = \frac{\vec{v}_{UTS}(3)}{\vec{v}_{UTS}(2)}, \quad c_2 = p_z - p_y m_2$$

The general equation for a plane has the form

$$A x + B y + C z = D \quad (16)$$

The values of A, B, C are the direction cosines of the normal to the shadowing plane and they may be determined in the following manner. Define two vectors  $\vec{v}_1$  and  $\vec{v}_2$  as:

$$\vec{U}_1 = (a_x - b_x) \vec{i} + (a_y - b_y) \vec{j} + (a_z - b_z) \vec{k}$$

$$\vec{U}_2 = (c_x - b_x) \vec{i} + (c_y - b_y) \vec{j} + (c_z - b_z) \vec{k}$$

and the normal vector  $\vec{N}$  is determined as follows .

$$\vec{N} = \frac{\vec{U}_1 \times \vec{U}_2}{|\vec{U}_1| |\vec{U}_2|} = A \vec{i} + B \vec{j} + C \vec{k}$$

and A, B, C are known.

Substituting the coordinates of any one point in the shadowing plane, the value of D is obtained:

$$D = A a_x + B a_y + C a_z \quad (17)$$

Thus the equations of the line and the plane are established.

It remains to be determined if the line intersects within the boundary encompassed by the point a, b, c, d. First, determine the coordinates of the point of intersection. Substitute 14 and 15 into 16 and solve for y. Knowing y, use equations 14 and 15 to solve for x and z. Next the vectors from the intersection i to the corners of the shadowing surface are tabulated

$$\begin{aligned}\vec{V}_1 &= (a_x - i_x) \vec{i} + (a_y - i_y) \vec{j} + (a_z - i_z) \vec{k} \\ \vec{V}_2 &= (b_x - i_x) \vec{i} + (b_y - i_y) \vec{j} + (b_z - i_z) \vec{k} \\ \vec{V}_3 &= \\ &\vdots \\ \vec{V}_n &= \end{aligned}$$

Then in sequence, find the sum of the absolute value of the cross products of  $\vec{V}_1$  with  $\vec{V}_2$ ,

$\vec{V}_2$  with  $\vec{V}_3, \dots, \vec{V}_{n-1}$  with  $\vec{V}_n$ , and  $\vec{V}_n$  with  $\vec{V}_1$ , completing the loop.

$$|\vec{V}_n \times \vec{V}_1| + \sum_{i=1}^{n-1} |\vec{V}_i \times \vec{V}_{i+1}| \geq 2A \quad (18)$$

If this sum equals exactly 2A, then the intersection point is within the boundary. If it is some value more than 2A, it lies outside the boundary. It should be noted that when the absolute value is not used, 18 always yields 2A. The numerical evaluation of 18 is straightforward. The cross product of  $\vec{V}_1$  and  $\vec{V}_2$  can be expressed as a determinant.

$$\vec{V}_1 \times \vec{V}_2 = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ (a_x - i_x) & (a_y - i_y) & (a_z - i_z) \\ (b_x - i_x) & (b_y - i_y) & (b_z - i_z) \end{vmatrix}$$

The value of  $\vec{V}_1 \times \vec{V}_2$  is then the square root of the sums of the squares of the coefficients of  $\vec{i}, \vec{j}, \vec{k}$ .



SECTION 3  
USER'S PROCEDURES

3.1 SUBROUTINE USE. This subroutine is a self contained link of the Space Visibility Program as defined by figure 1. However, several modes of operational use exist. The user can by use of the operational flags SOURCE and SHADOW elect at will the inclusion or exclusion of any source energy or shadowing computation for that source to the illuminance calculations. Observer shadowing calculations may also be excluded by the shadow option. A second pair of input options NR & NC serve to define the number of elemental areas to be considered on the surface of the moon. NR indicates the number of "rows" around the moon with the sub-vehicle point as the pole. NC indicates the number of "columns" to the horizon. The reader should examine figure 8 for a full understanding of the use of these options. The subroutine is presently programmed to handle a maximum number of elements  $(NC) \times (NR) = 400$ . If by error the product  $(NC) \times (NR)$  is outside of the range of 1 thru 400, NC is set to 10 and NR set to 40. All necessary information for calculation of the target description as defined by the interface document of APPENDIX A is contained in the deck of cards labeled TDM and associated subroutines, and associated subroutines, is communicated to subroutine TDM via the common named NASA (see Section 3.2 below), and is read into computer memory by TDM from a magnetic tape, which is written by the auxiliary program 3960A. This tape contains a geometric and reflectivity description of the target vehicle.

3.2 INTERFACE INFORMATION

COMMON/NASA/

<u>Input Variable</u>	<u>Dimension</u>	<u>Relative Location in Common NASA</u>
SPOSX	3	0
EPOSX	3	3
TPOSX	3	6
OPOSX	3	9
TATT	3	12
SOURCE	1	15
SHADOW	1	16
NR	1	17
NC	1	18
<u>Output Variable</u>		
VIS	1	19
B	1	20

Users Options: SOURCE, SHADOW, and NR & NC.

The dictionary Section 6.2 describes the use of the SOURCE & SHADOW option flags and also defines VIS and B.

3.3 SAMPLE CASE

SUBROUTINE TDM READS THE FOLLOWING TARGET GEOMETRIC INFORMATION FROM A MAGNETIC TAPE, WHICH IS CREATED BY THE AUXILIARY PROGRAM 3960 A.

NRE 7  
REFLECTOR AREAS  
1 .5  
2 .5  
3 .5  
4 .5  
5 2  
6 4  
7 2  
REFLECTOR UNIT NORMALS  
1 1 0 0  
2 1 0 0  
3 1 0 0  
4 1 0 0  
5 0 0 -1  
6 0 -1 0  
7 0 0 1  
REFLECTOR CENTERS  
1 1 .25 .5  
2 1 .25 1.5  
3 1 .75 1.5  
4 1 .75 .5  
5 1 .5 0  
6 1 0 1  
7 1 .5 2  
NSURF 4  
INDEX OF FIRST REFLECTOR FOR EACH SURFACE  
1 1  
2 5  
3 6  
4 7  
5 8  
TARGET SURFACE MATERIALS  
1  
2  
3  
4  
SHADOWER NUMBERS FOR EACH SURFACE  
1 1 2 3  
2 0 0 0  
3 0 0 0  
4 0 0 0  
NS 3  
SHADOWER DOUBLE AREAS  
1 4  
2 8  
3 4

SHADOWER UNIT NORMALS

1	0	0	-1
2	0	-1	0
3	0	0	1

INDEX OF FIRST CORNERS FOR EACH SHADOWER

1	1
2	5
3	9
4	13

SHADOWER CORNERS

12			
1	2	0	0
2	0	0	0
3	0	1	0
4	2	1	0
5	2	0	0
6	0	0	0
7	0	0	2
8	2	0	2
9	2	1	2
10	0	1	2
11	0	0	2
12	2	0	2

THE FOLLOWING INFORMATION IS GIVEN TO  
SUBROUTINE TDM VIA COMMON NASA.

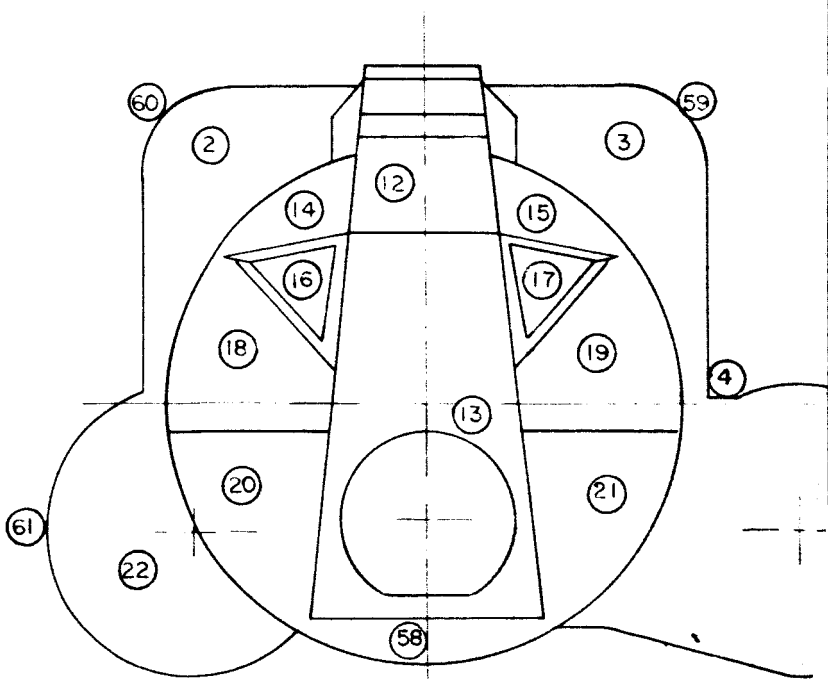
NR	40	NC	10
SOURCE	7	SHADOW	15
SPOS	0	1.5E11	0
EPOS	4.E08	0	0
TPOS	-3.476E6	3.476E6	-3.476E6
OPOS	0	3.476E6	0
TATT	10	10	0

3.4 SAMPLE CASE RESULTS

B=.35378831E-11 VIS=7

THE CHECK CASE IS FOR PROGRAM LOGIC CHECK. IT MAKES USE OF DUMMY GEOMETRIC DATA AND FOR ALL CASES SETS THE BI-DIRECTIONAL REFLECTANCE TO THE VALUE ONE. IT IS IN NO WAY REPRESENTATIVE OF THE LEM.

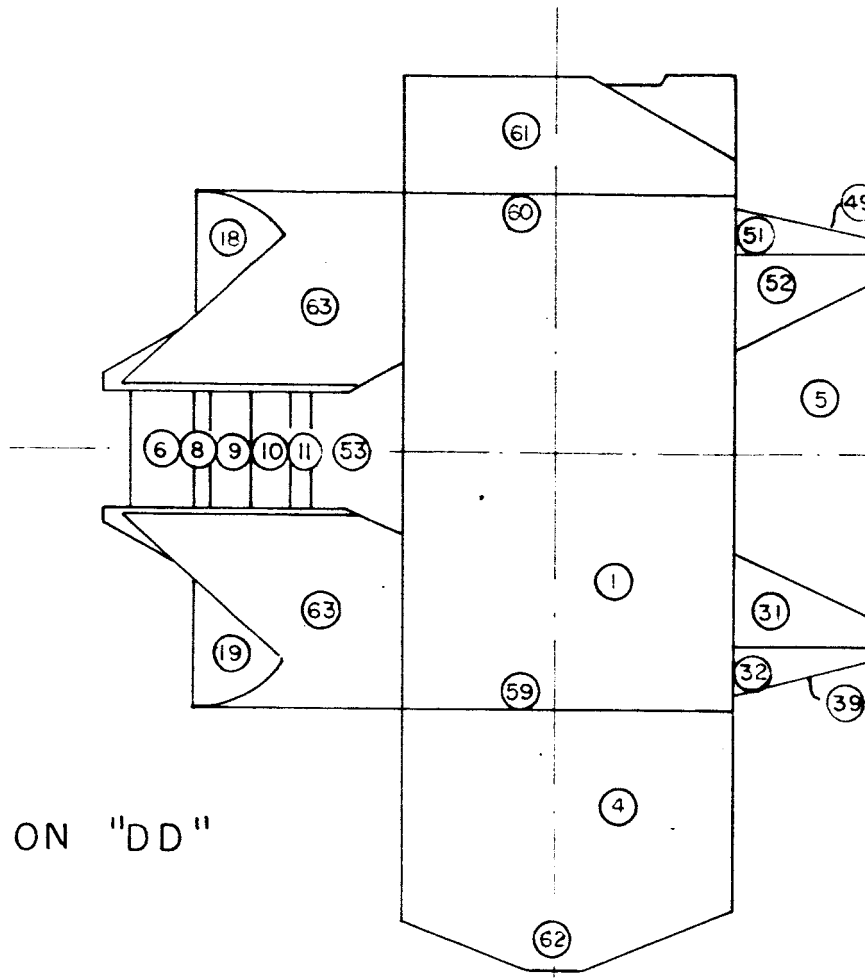
FIG. II : LEM ASCENT STA  
SHOWING MAPPED



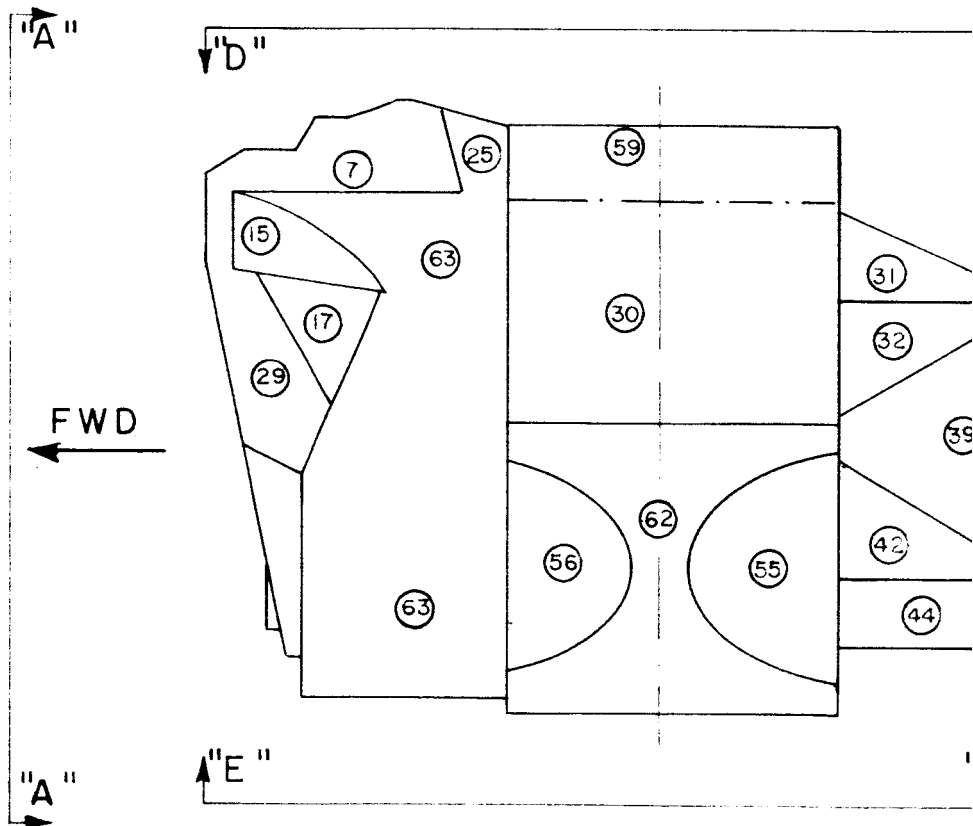
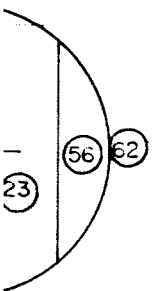
30①

VIEW ON "AA "

GEOMETRY SURFACES

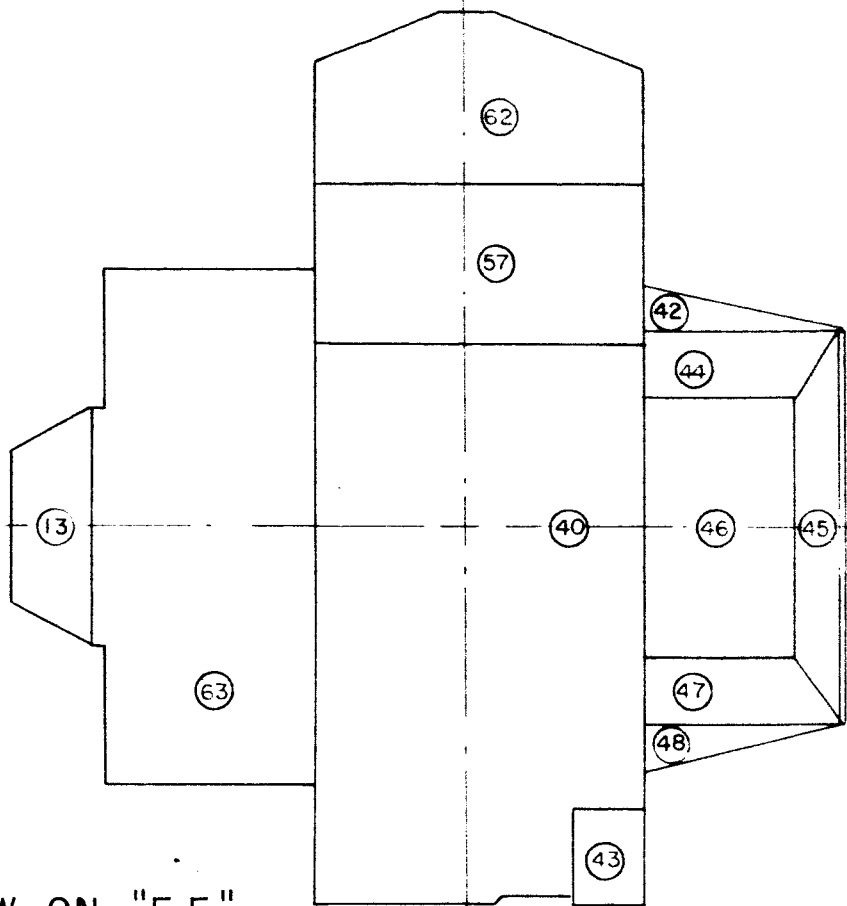


VIEW ON "DD"



30 (2)

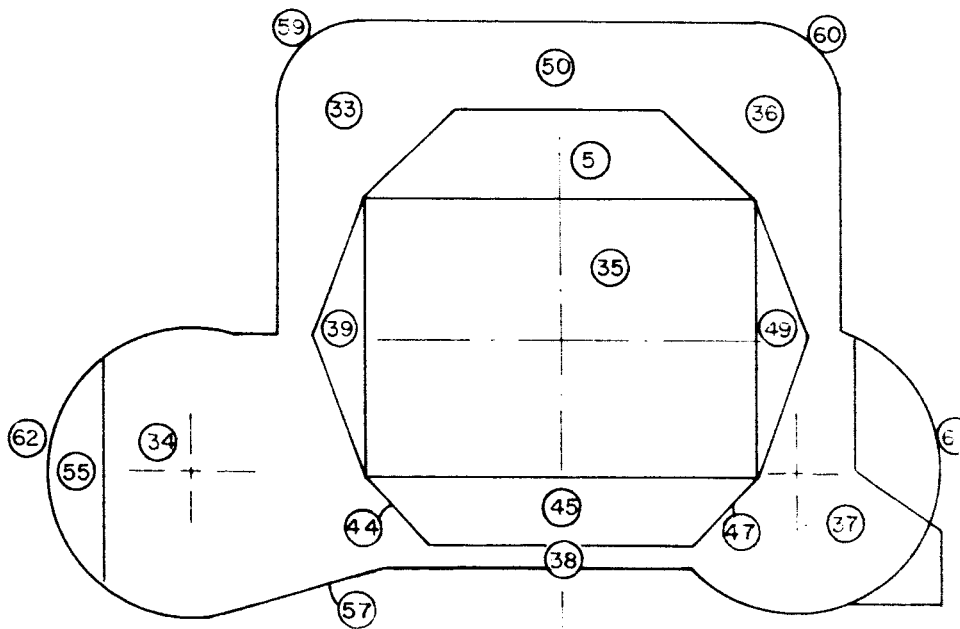
SIDE VIEW



VIEW ON "E E"

"D"

"B"

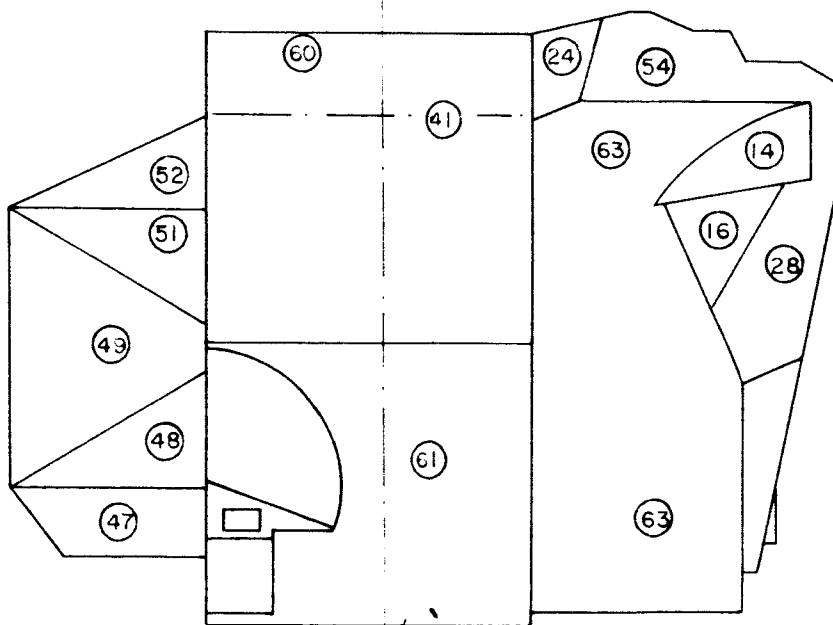


"B"

303

VIEW ON "BB"

SCALE 1/36 SIZE



VIEW ON "CC"

30  
④

SECTION 4  
LEM VEHICLE DESCRIPTION

4.1 DISCUSSION OF MAPPING PROCEDURES. The concept of mapping the vehicle into elemental areas for illumination calculations was discussed in Section 2. This section deals with the specific vehicle surface elements, their definitions and the potential shadowers involved with each. Figure 11 shows a six view drawing of the LEM on which each of the reflecting surfaces have been marked. All data contained in the tables of this section were obtained by use of the LEM drawings of reference 7. In many instances (where dimensions were not supplied by the drawings) data was extracted from the drawings by use of a scale and/or protractor. For singly canted surfaces normal vectors are readily obtainable by the usual procedures of geometry. For doubly canted surfaces, normal vectors were obtained by taking the vector cross product of two lines lying within the surface. Where shadowing calculations are involved the shadowed elements were mapped into areas less than  $.01 \text{ meters}^2$ , this number was determined more by machine storage limitations and an estimate of running times rather than by any careful analysis of error. The reader is referred to the Numerical Integration section of reference 6 for a discussion of error. Section 4.2 of this report consists of three tables; Table I describes the surface appearance and lists the shadowers of that surface, Table II describes the orientation and location of the surfaces in the LEM vehicle reference system as defined by the drawings reference 7. It should be noted that the origin of this system lies outside the ascent stage in the direction of negative "X". While for the dimensions involved in calculations performed here, this can have but little importance, if it is desired to place the origin at the c.g. a constant value of X may be subtracted from all the location data of Table II. Table III defines all of the shadowers in terms of the corner points. The area and direction cosines of the shadowers are also listed.

All of the tables are prepared by the auxiliary program 3960A, which, in addition to listing all the geometric data in tabular form, writes both the geometric and reflectivity data in binary form on a magnetic tape for use by the TDM subroutine.



4.2 TARGET DESCRIPTION LISTING

VISIBILITY IN SPACE TARGET DESCRIPTION PROGRAM  
CONVAIR CONTRACT NAS 9-4814 FOR THE LEM VEHICLE

THE VEHICLE IS DESCRIBED BY  
63 SURFACES 2349 ELEMENTAL REFLECTOR AREAS AND 34 SHADOWERS

TABLE I

SURFACE NO.	COATING NO.	COATING APPEARANCE	SHADOWABLE
1	1	ALUMINUM PAINT	NO
2	1	ALUMINUM PAINT	YES BY 1 2 3
3	1	ALUMINUM PAINT	YES BY 4 5 6
4	1	ALUMINUM PAINT	YES BY 7
5	1	ALUMINUM PAINT	NO
6	1	ALUMINUM PAINT	NO
7	1	ALUMINUM PAINT	YES BY 5 8
8	1	ALUMINUM PAINT	NO
9	1	ALUMINUM PAINT	NO
10	1	ALUMINUM PAINT	NO
11	1	ALUMINUM PAINT	NO
12	1	ALUMINUM PAINT	NO
13	1	ALUMINUM PAINT	NO
14	1	ALUMINUM PAINT	NO
15	1	ALUMINUM PAINT	NO
16	1	ALUMINUM PAINT	NO
17	1	ALUMINUM PAINT	NO
18	1	ALUMINUM PAINT	NO
19	1	ALUMINUM PAINT	NO
20	1	ALUMINUM PAINT	YES BY 9
21	1	ALUMINUM PAINT	YES BY 10
22	1	ALUMINUM PAINT	YES BY 11 12
23	1	ALUMINUM PAINT	YES BY 13 14
24	1	ALUMINUM PAINT	YES BY 2 15
25	1	ALUMINUM PAINT	YES BY 5 8
26	1	ALUMINUM PAINT	NO
27	1	ALUMINUM PAINT	NO
28	1	ALUMINUM PAINT	NO
29	1	ALUMINUM PAINT	NO
30	1	ALUMINUM PAINT	YES BY 16
31	1	ALUMINUM PAINT	YES BY 17 19
32	1	ALUMINUM PAINT	YES BY 17 19
33	1	ALUMINUM PAINT	YES BY 18 20 21
34	1	ALUMINUM PAINT	YES BY 18 20 21
35	1	ALUMINUM PAINT	NO
36	1	ALUMINUM PAINT	YES BY 22 23
37	1	ALUMINUM PAINT	YES BY 22 23 24
38	1	ALUMINUM PAINT	YES BY 25
39	1	ALUMINUM PAINT	YES BY 17 18 19
40	1	ALUMINUM PAINT	NO
41	1	ALUMINUM PAINT	YES BY 26
42	1	ALUMINUM PAINT	YES BY 17 19
43	1	ALUMINUM PAINT	NO
44	1	ALUMINUM PAINT	YES BY 19

TABLE I

SURFACE NO.	COATING NO.	COATING APPEARANCE	SHADOWABLE					
45	1	ALUMINUM PAINT	NO					
46	1	ALUMINUM PAINT	YES	BY	27			
47	1	ALUMINUM PAINT	YES	BY	28	29		
48	1	ALUMINUM PAINT	YES	BY	28	29		
49	1	ALUMINUM PAINT	YES	BY	28	29	31	
50	1	ALUMINUM PAINT	YES	BY	30			
51	1	ALUMINUM PAINT	YES	BY	28	29	31	
52	1	ALUMINUM PAINT	YES	BY	31			
53	1	ALUMINUM PAINT	NO					
54	1	ALUMINUM PAINT	YES	BY	2	15		
55	1	ALUMINUM PAINT	NO					
56	1	ALUMINUM PAINT	NO					
57	1	ALUMINUM PAINT	NO					
58	1	ALUMINUM PAINT	NO					
59	1	ALUMINUM PAINT	NO					
60	1	ALUMINUM PAINT	NO					
61	1	ALUMINUM PAINT	NO					
62	1	ALUMINUM PAINT	NO					
63	1	ALUMINUM PAINT	YES	BY	32	33	34	

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1	1	1	3.0900000	1.00000	0.	0.			
2	1	2	0.0100000	0.	0.	1.00000	6.4900	1.3210	0.7370
3	2	2	0.0031000	0.	0.	1.00000	6.4900	1.2550	0.7370
4	3	2	0.0100000	0.	0.	1.00000	6.5900	1.3210	0.7370
5	4	2	0.0033000	0.	0.	1.00000	6.5900	1.2510	0.7370
6	5	2	0.0100000	0.	0.	1.00000	6.6900	1.3210	0.7370
7	6	2	0.0051000	0.	0.	1.00000	6.6900	1.2460	0.7370
8	7	2	0.0100000	0.	0.	1.00000	6.7900	1.3210	0.7370
9	8	2	0.0079000	0.	0.	1.00000	6.7900	1.2310	0.7370
10	9	2	0.0100000	0.	0.	1.00000	6.8900	1.3210	0.7370
11	10	2	0.0111000	0.	0.	1.00000	6.8900	1.2160	0.7370
12	11	2	0.0100000	0.	0.	1.00000	6.9900	1.3210	0.7370
13	12	2	0.0100000	0.	0.	1.00000	6.9900	1.2210	0.7370
14	13	2	0.0032000	0.	0.	1.00000	6.9900	1.1550	0.7370
15	14	2	0.0100000	0.	0.	1.00000	7.0900	1.3210	0.7370
16	15	2	0.0100000	0.	0.	1.00000	7.0900	1.2210	0.7370
17	16	2	0.0111000	0.	0.	1.00000	7.0900	1.1150	0.7370
18	17	2	0.0100000	0.	0.	1.00000	7.1900	1.3210	0.7370
19	18	2	0.0100000	0.	0.	1.00000	7.1900	1.2210	0.7370
20	19	2	0.0100000	0.	0.	1.00000	7.1900	1.1210	0.7370
21	20	2	0.0081000	0.	0.	1.00000	7.1900	1.0310	0.7370
22	21	2	0.0100000	0.	0.	1.00000	7.2900	1.3210	0.7370
23	22	2	0.0100000	0.	0.	1.00000	7.2900	1.2210	0.7370
24	23	2	0.0100000	0.	0.	1.00000	7.2900	1.1210	0.7370
25	24	2	0.0100000	0.	0.	1.00000	7.2900	1.0210	0.7370
26	25	2	0.0066000	0.	0.	1.00000	7.2900	0.9380	0.7370
27	26	2	0.0100000	0.	0.	1.00000	7.3900	1.3210	0.7370
28	27	2	0.0100000	0.	0.	1.00000	7.3900	1.2210	0.7370
29	28	2	0.0100000	0.	0.	1.00000	7.3900	1.1210	0.7370
30	29	2	0.0100000	0.	0.	1.00000	7.3900	1.0210	0.7370
31	30	2	0.0100000	0.	0.	1.00000	7.3900	0.9210	0.7370
32	31	2	0.0071000	0.	0.	1.00000	7.3900	0.8360	0.7370
33	32	2	0.0100000	0.	0.	1.00000	7.4900	1.3210	0.7370
34	33	2	0.0100000	0.	0.	1.00000	7.4900	1.2210	0.7370
35	34	2	0.0100000	0.	0.	1.00000	7.4900	1.1210	0.7370
36	35	2	0.0100000	0.	0.	1.00000	7.4900	1.0210	0.7370
37	36	2	0.0100000	0.	0.	1.00000	7.4900	0.9210	0.7370
38	37	2	0.0100000	0.	0.	1.00000	7.4900	0.8210	0.7370
39	38	2	0.0107000	0.	0.	1.00000	7.4900	0.7680	0.7370
40	39	2	0.0098000	0.	0.	1.00000	7.5900	1.3200	0.7370
41	40	2	0.0100000	0.	0.	1.00000	7.5900	1.2210	0.7370
42	41	2	0.0100000	0.	0.	1.00000	7.5900	1.1210	0.7370
43	42	2	0.0100000	0.	0.	1.00000	7.5900	1.0210	0.7370
44	43	2	0.0100000	0.	0.	1.00000	7.5900	0.9210	0.7370
45	44	2	0.0100000	0.	0.	1.00000	7.5900	0.8210	0.7370
46	45	2	0.0100000	0.	0.	1.00000	7.5900	0.7210	0.7370
47	46	2	0.0100000	0.	0.	1.00000	7.5900	0.6210	0.7370

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
48	47	2	0.0099000	0.	0.	1.00000	7.5900	0.5210	0.7370
49	48	2	0.0076000	0.	0.	1.00000	7.6900	1.3090	0.7370
50	49	2	0.0100000	0.	0.	1.00000	7.6900	1.2210	0.7370
51	50	2	0.0100000	0.	0.	1.00000	7.6900	1.1210	0.7370
52	51	2	0.0100000	0.	0.	1.00000	7.6900	1.0210	0.7370
53	52	2	0.0100000	0.	0.	1.00000	7.6900	0.9210	0.7370
54	53	2	0.0100000	0.	0.	1.00000	7.6900	0.8210	0.7370
55	54	2	0.0100000	0.	0.	1.00000	7.6900	0.7210	0.7370
56	55	2	0.0100000	0.	0.	1.00000	7.6900	0.6210	0.7370
57	56	2	0.0100000	0.	0.	1.00000	7.6900	0.5210	0.7370
58	57	2	0.0100000	0.	0.	1.00000	7.6900	0.4210	0.7370
59	58	2	0.0056000	0.	0.	1.00000	7.6900	0.3430	0.7370
60	59	2	0.0122000	0.	0.	1.00000	7.7900	1.2320	0.7370
61	60	2	0.0100000	0.	0.	1.00000	7.7900	1.1210	0.7370
62	61	2	0.0100000	0.	0.	1.00000	7.7900	1.0210	0.7370
63	62	2	0.0100000	0.	0.	1.00000	7.7900	0.9210	0.7370
64	63	2	0.0100000	0.	0.	1.00000	7.7900	0.8210	0.7370
65	64	2	0.0100000	0.	0.	1.00000	7.7900	0.7210	0.7370
66	65	2	0.0100000	0.	0.	1.00000	7.7900	0.6210	0.7370
67	66	2	0.0100000	0.	0.	1.00000	7.7900	0.5210	0.7370
68	67	2	0.0100000	0.	0.	1.00000	7.7900	0.4210	0.7370
69	68	2	0.0071000	0.	0.	1.00000	7.7900	0.3360	0.7370
70	69	2	0.0117000	0.	0.	1.00000	7.8900	1.1300	0.7370
71	70	2	0.0100000	0.	0.	1.00000	7.8900	1.0210	0.7370
72	71	2	0.0100000	0.	0.	1.00000	7.8900	0.9210	0.7370
73	72	2	0.0100000	0.	0.	1.00000	7.8900	0.8210	0.7370
74	73	2	0.0100000	0.	0.	1.00000	7.8900	0.7210	0.7370
75	74	2	0.0100000	0.	0.	1.00000	7.8900	0.6210	0.7370
76	75	2	0.0100000	0.	0.	1.00000	7.8900	0.5210	0.7370
77	76	2	0.0100000	0.	0.	1.00000	7.8900	0.4210	0.7370
78	77	2	0.0075000	0.	0.	1.00000	7.8900	0.3340	0.7370
79	78	2	0.0006500	0.	0.	1.00000	7.9450	1.1030	0.7370
80	79	2	0.0010000	0.	0.	1.00000	7.9450	1.0210	0.7370
81	80	2	0.0010000	0.	0.	1.00000	7.9450	0.9210	0.7370
82	81	2	0.0010000	0.	0.	1.00000	7.9450	0.8210	0.7370
83	82	2	0.0010000	0.	0.	1.00000	7.9450	0.7210	0.7370
84	83	2	0.0010000	0.	0.	1.00000	7.9450	0.6210	0.7370
85	84	2	0.0010000	0.	0.	1.00000	7.9450	0.5210	0.7370
86	85	2	0.0010000	0.	0.	1.00000	7.9450	0.4210	0.7370
87	86	2	0.0008700	0.	0.	1.00000	7.9450	0.3280	0.7370
88	1	3	0.0100000	0.	0.	1.00000	6.4900	-1.3210	0.7370
89	2	3	0.0031000	0.	0.	1.00000	6.4900	-1.2550	0.7370
90	3	3	0.0100000	0.	0.	1.00000	6.5900	-1.3210	0.7370
91	4	3	0.0033000	0.	0.	1.00000	6.5900	-1.2510	0.7370
92	5	3	0.0100000	0.	0.	1.00000	7.1900	-1.1210	0.7370
93	6	3	0.0100000	0.	0.	1.00000	6.6900	-1.3210	0.7370
94	7	3	0.0051000	0.	0.	1.00000	6.6900	-1.2460	0.7370

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
95	8	3	0.0100000	0.	0.	1.00000	6.7900	-1.3210	0.7370
96	9	3	0.0079000	0.	0.	1.00000	6.7900	-1.2310	0.7370
97	10	3	0.0100000	0.	0.	1.00000	6.8900	-1.3210	0.7370
98	11	3	0.0111000	0.	0.	1.00000	6.8900	-1.2160	0.7370
99	12	3	0.0100000	0.	0.	1.00000	6.9900	-1.3210	0.7370
100	13	3	0.0100000	0.	0.	1.00000	6.9900	-1.2210	0.7370
101	14	3	0.0032000	0.	0.	1.00000	6.9900	-1.1550	0.7370
102	15	3	0.0100000	0.	0.	1.00000	7.0900	-1.3210	0.7370
103	16	3	0.0100000	0.	0.	1.00000	7.0900	-1.2210	0.7370
104	17	3	0.0111000	0.	0.	1.00000	7.0900	-1.1150	0.7370
105	18	3	0.0100000	0.	0.	1.00000	7.1900	-1.3210	0.7370
106	19	3	0.0100000	0.	0.	1.00000	7.1900	-1.2210	0.7370
107	20	3	0.0081000	0.	0.	1.00000	7.1900	-1.0310	0.7370
108	21	3	0.0100000	0.	0.	1.00000	7.2900	-1.3210	0.7370
109	22	3	0.0100000	0.	0.	1.00000	7.2900	-1.2210	0.7370
110	23	3	0.0100000	0.	0.	1.00000	7.2900	-1.1210	0.7370
111	24	3	0.0100000	0.	0.	1.00000	7.2900	-1.0210	0.7370
112	25	3	0.0066000	0.	0.	1.00000	7.2900	-0.9380	0.7370
113	26	3	0.0100000	0.	0.	1.00000	7.3900	-1.3210	0.7370
114	27	3	0.0100000	0.	0.	1.00000	7.3900	-1.2210	0.7370
115	28	3	0.0100000	0.	0.	1.00000	7.3900	-1.1210	0.7370
116	29	3	0.0100000	0.	0.	1.00000	7.3900	-1.0210	0.7370
117	30	3	0.0100000	0.	0.	1.00000	7.3900	-0.9210	0.7370
118	31	3	0.0071000	0.	0.	1.00000	7.3900	-0.8360	0.7370
119	32	3	0.0100000	0.	0.	1.00000	7.4900	-1.3210	0.7370
120	33	3	0.0100000	0.	0.	1.00000	7.4900	-1.2210	0.7370
121	34	3	0.0100000	0.	0.	1.00000	7.4900	-1.1210	0.7370
122	35	3	0.0100000	0.	0.	1.00000	7.4900	-1.0210	0.7370
123	36	3	0.0100000	0.	0.	1.00000	7.4900	-0.9210	0.7370
124	37	3	0.0100000	0.	0.	1.00000	7.4900	-0.8210	0.7370
125	38	3	0.0107000	0.	0.	1.00000	7.4900	-0.7680	0.7370
126	39	3	0.0098000	0.	0.	1.00000	7.5900	-1.3200	0.7370
127	40	3	0.0100000	0.	0.	1.00000	7.5900	-1.2210	0.7370
128	41	3	0.0100000	0.	0.	1.00000	7.5900	-1.1210	0.7370
129	42	3	0.0100000	0.	0.	1.00000	7.5900	-1.0210	0.7370
130	43	3	0.0100000	0.	0.	1.00000	7.5900	-0.9210	0.7370
131	44	3	0.0100000	0.	0.	1.00000	7.5900	-0.8210	0.7370
132	45	3	0.0100000	0.	0.	1.00000	7.5900	-0.7210	0.7370
133	46	3	0.0100000	0.	0.	1.00000	7.5900	-0.6210	0.7370
134	47	3	0.0099000	0.	0.	1.00000	7.5900	-0.5210	0.7370
135	48	3	0.0076000	0.	0.	1.00000	7.6900	-1.3090	0.7370
136	49	3	0.0100000	0.	0.	1.00000	7.6900	-1.2210	0.7370
137	50	3	0.0100000	0.	0.	1.00000	7.6900	-1.1210	0.7370
138	51	3	0.0100000	0.	0.	1.00000	7.6900	-1.0210	0.7370
139	52	3	0.0100000	0.	0.	1.00000	7.6900	-0.9210	0.7370
140	53	3	0.0100000	0.	0.	1.00000	7.6900	-0.8210	0.7370
141	54	3	0.0100000	0.	0.	1.00000	7.6900	-0.7210	0.7370

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
142	55	3	0.0100000	0.	0.	1.00000	7.6900	-0.6210	0.7370
143	56	3	0.0100000	0.	0.	1.00000	7.6900	-0.5210	0.7370
144	57	3	0.0100000	0.	0.	1.00000	7.6900	-0.4210	0.7370
145	58	3	0.0056000	0.	0.	1.00000	7.6900	-0.3430	0.7370
146	59	3	0.0122000	0.	0.	1.00000	7.7900	-1.2320	0.7370
147	60	3	0.0100000	0.	0.	1.00000	7.7900	-1.1210	0.7370
148	61	3	0.0100000	0.	0.	1.00000	7.7900	-1.0210	0.7370
149	62	3	0.0100000	0.	0.	1.00000	7.7900	-0.9210	0.7370
150	63	3	0.0100000	0.	0.	1.00000	7.7900	-0.8210	0.7370
151	64	3	0.0100000	0.	0.	1.00000	7.7900	-0.7210	0.7370
152	65	3	0.0100000	0.	0.	1.00000	7.7900	-0.6210	0.7370
153	66	3	0.0100000	0.	0.	1.00000	7.7900	-0.5210	0.7370
154	67	3	0.0100000	0.	0.	1.00000	7.7900	-0.4210	0.7370
155	68	3	0.0071000	0.	0.	1.00000	7.7900	-0.3360	0.7370
156	69	3	0.0117000	0.	0.	1.00000	7.8900	-1.1300	0.7370
157	70	3	0.0100000	0.	0.	1.00000	7.8900	-1.0210	0.7370
158	71	3	0.0100000	0.	0.	1.00000	7.8900	-0.9210	0.7370
159	72	3	0.0100000	0.	0.	1.00000	7.8900	-0.8210	0.7370
160	73	3	0.0100000	0.	0.	1.00000	7.8900	-0.7210	0.7370
161	74	3	0.0100000	0.	0.	1.00000	7.8900	-0.6210	0.7370
162	75	3	0.0100000	0.	0.	1.00000	7.8900	-0.5210	0.7370
163	76	3	0.0100000	0.	0.	1.00000	7.8900	-0.4210	0.7370
164	77	3	0.0075000	0.	0.	1.00000	7.8900	-0.3340	0.7370
165	78	3	0.0006500	0.	0.	1.00000	7.9450	-1.1030	0.7370
166	79	3	0.0010000	0.	0.	1.00000	7.9450	-1.0210	0.7370
167	80	3	0.0010000	0.	0.	1.00000	7.9450	-0.9210	0.7370
168	81	3	0.0010000	0.	0.	1.00000	7.9450	-0.8210	0.7370
169	82	3	0.0010000	0.	0.	1.00000	7.9450	-0.7210	0.7370
170	83	3	0.0010000	0.	0.	1.00000	7.9450	-0.6210	0.7370
171	84	3	0.0010000	0.	0.	1.00000	7.9450	-0.5210	0.7370
172	85	3	0.0010000	0.	0.	1.00000	7.9450	-0.4210	0.7370
173	86	3	0.0008700	0.	0.	1.00000	7.9450	-0.3280	0.7370
174	1	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	0.6800
175	2	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	0.5800
176	3	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	0.4800
177	4	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	0.3800
178	5	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	0.2800
179	6	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	0.1800
180	7	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	0.0800
181	8	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	-0.0200
182	9	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	-0.1200
183	10	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	-0.2200
184	11	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	-0.3200
185	12	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	-0.4200
186	13	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	-0.5200
187	14	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	-0.6200
188	15	4	0.0100000	1.00000	0.	0.	6.4500	-1.4200	-0.7200

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
189	16	4	0.0093600	1.00000	0.	0.	6.4500	-1.4200	-0.8168
190	17	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	0.6800
191	18	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	0.5800
192	19	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	0.9800
193	20	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	0.3800
194	21	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	0.2800
195	22	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	0.1800
196	23	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	0.0800
197	24	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	-0.0200
198	25	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	-0.1200
199	26	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	-0.2200
200	27	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	-0.3200
201	28	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	-0.4200
202	29	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	-0.5200
203	30	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	-0.6200
204	31	4	0.0100000	1.00000	0.	0.	6.4500	-1.5069	-0.7200
205	32	4	0.0093600	1.00000	0.	0.	6.4500	-1.5069	-0.8168
206	1	5	1.4700000	0.90968	0.	-0.41530			
207	1	6	0.1590000	1.00000	0.	0.			
208	1	7	0.0100000	0.10934	-0.99400	0.	7.7478	-0.2910	2.1400
209	2	7	0.0100000	0.10934	-0.99400	0.	7.7478	-0.2910	2.0400
210	3	7	0.0100000	0.10934	-0.99400	0.	7.7478	-0.2910	1.9400
211	4	7	0.0100000	0.10934	-0.99400	0.	7.7478	-0.2910	1.8400
212	5	7	0.0100000	0.10934	-0.99400	0.	7.7478	-0.2910	1.7400
213	6	7	0.0100000	0.10934	-0.99400	0.	7.7478	-0.2910	1.6400
214	7	7	0.0100000	0.10934	-0.99400	0.	7.7478	-0.2910	1.5400
215	8	7	0.0100000	0.10934	-0.99400	0.	7.7478	-0.2910	1.4400
216	9	7	0.0100000	0.10934	-0.99400	0.	7.7478	-0.2910	1.3400
217	10	7	0.0100000	0.10934	-0.99400	0.	7.7478	-0.2910	1.2400
218	11	7	0.0100000	0.10934	-0.99400	0.	7.7478	-0.2910	1.1400
219	12	7	0.0100000	0.10934	-0.99400	0.	7.7478	-0.2910	1.0400
220	13	7	0.0100000	0.10934	-0.99400	0.	7.7478	-0.2910	0.9400
221	14	7	0.0100000	0.10934	-0.99400	0.	7.7478	-0.2910	0.8400
222	15	7	0.0052400	0.10934	-0.99400	0.	7.7478	-0.2910	0.7640
223	16	7	0.0086710	0.10934	-0.99400	0.	7.6545	-0.3030	2.1400
224	17	7	0.0086710	0.10934	-0.99400	0.	7.6545	-0.3030	2.0400
225	18	7	0.0086710	0.10934	-0.99400	0.	7.6545	-0.3030	1.9400
226	19	7	0.0086710	0.10934	-0.99400	0.	7.6545	-0.3030	1.8400
227	20	7	0.0086710	0.10934	-0.99400	0.	7.6545	-0.3030	1.7400
228	21	7	0.0086710	0.10934	-0.99400	0.	7.6545	-0.3030	1.6400
229	22	7	0.0086710	0.10934	-0.99400	0.	7.6545	-0.3030	1.5400
230	23	7	0.0086710	0.10934	-0.99400	0.	7.6545	-0.3030	1.4400
231	24	7	0.0086710	0.10934	-0.99400	0.	7.6545	-0.3030	1.3400
232	25	7	0.0086710	0.10934	-0.99400	0.	7.6545	-0.3030	1.2400
233	26	7	0.0086710	0.10934	-0.99400	0.	7.6545	-0.3030	1.1400
234	27	7	0.0086710	0.10934	-0.99400	0.	7.6545	-0.3030	1.0400
235	28	7	0.0086710	0.10934	-0.99400	0.	7.6545	-0.3030	0.9400

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE		
				I	J	K	VEHICLE COORDINATE SYSTEM		
							X	Y	Z
236	29	7	0.0086710	0.10934	-0.99400	0.	7.6545	-0.3030	0.8400
237	30	7	0.0045400	0.10934	-0.99400	0.	7.6545	-0.3030	0.7640
238	31	7	0.0100524	0.10934	-0.99400	0.	7.9630	-0.2670	0.9450
239	32	7	0.0100524	0.10934	-0.99400	0.	7.9630	-0.2670	1.0450
240	33	7	0.0100524	0.10934	-0.99400	0.	7.9630	-0.2670	1.1450
241	34	7	0.0116608	0.10934	-0.99400	0.	7.9630	-0.2670	1.2530
242	35	7	0.0115603	0.10934	-0.99400	0.	7.8555	-0.2790	0.7870
243	36	7	0.0115603	0.10934	-0.99400	0.	7.8555	-0.2790	0.8870
244	37	7	0.0115603	0.10934	-0.99400	0.	7.8555	-0.2790	0.9870
245	38	7	0.0115603	0.10934	-0.99400	0.	7.8555	-0.2790	1.0870
246	39	7	0.0115603	0.10934	-0.99400	0.	7.8555	-0.2790	1.1870
247	40	7	0.0115603	0.10934	-0.99400	0.	7.8555	-0.2790	1.2870
248	41	7	0.0115603	0.10934	-0.99400	0.	7.8555	-0.2790	1.3870
249	42	7	0.0115603	0.10934	-0.99400	0.	7.8555	-0.2790	1.4870
250	43	7	0.0115603	0.10934	-0.99400	0.	7.8555	-0.2790	1.5870
251	44	7	0.0108667	0.10934	-0.99400	0.	7.8555	-0.2790	1.6840
252	1	8	0.1170000	0.43000	0.	0.90283			
253	1	9	0.1110000	1.00000	0.	0.			
254	1	10	0.1110000	0.94963	0.	0.31337			
255	1	11	0.0584000	1.00000	0.	0.			
256	1	12	0.3105000	0.	0.	1.00000			
257	1	13	1.7400000	-0.18666	0.	0.98242			
258	1	14	0.2540000	0.	0.74296	0.66934			
259	1	15	0.2540000	0.	-0.74296	0.66934			
260	1	16	0.2853000	-0.30491	0.69743	0.64855			
261	1	17	0.2853000	-0.30491	-0.69743	0.64855			
262	1	18	0.4500000	0.42536	0.	0.90502			
263	1	19	0.4500000	0.42536	0.	0.90502			
264	1	20	0.0100000	0.	0.	1.00000	6.2800	1.1890	1.7527
265	2	20	0.0100000	0.	0.	1.00000	6.2800	1.0890	1.7527
266	3	20	0.0100000	0.	0.	1.00000	6.2800	0.9890	1.7527
267	4	20	0.0100000	0.	0.	1.00000	6.2800	0.8890	1.7527
268	5	20	0.0100000	0.	0.	1.00000	6.2800	0.7890	1.7527
269	6	20	0.0100000	0.	0.	1.00000	6.2800	0.6890	1.7527
270	7	20	0.0100000	0.	0.	1.00000	6.2800	0.5890	1.7527
271	8	20	0.0067000	0.	0.	1.00000	6.2800	0.5055	1.7527
272	9	20	0.0100000	0.	0.	1.00000	6.1800	1.1750	1.7527
273	10	20	0.0100000	0.	0.	1.00000	6.1800	1.0750	1.7527
274	11	20	0.0100000	0.	0.	1.00000	6.1800	0.9750	1.7527
275	12	20	0.0100000	0.	0.	1.00000	6.1800	0.8750	1.7527
276	13	20	0.0100000	0.	0.	1.00000	6.1800	0.7750	1.7527
277	14	20	0.0100000	0.	0.	1.00000	6.1800	0.6750	1.7527
278	15	20	0.0100000	0.	0.	1.00000	6.1800	0.5750	1.7527
279	16	20	0.0044000	0.	0.	1.00000	6.1800	0.5030	1.7527
280	17	20	0.0100000	0.	0.	1.00000	6.0800	1.1530	1.7527
281	18	20	0.0100000	0.	0.	1.00000	6.0800	1.0530	1.7527
282	19	20	0.0100000	0.	0.	1.00000	6.0800	0.9530	1.7527



TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
283	20	20	0.0100000	0.	0.	1.00000	6.0800	0.8530	1.7527
284	21	20	0.0100000	0.	0.	1.00000	6.0800	0.7530	1.7527
285	22	20	0.0100000	0.	0.	1.00000	6.0800	0.6530	1.7527
286	23	20	0.0112000	0.	0.	1.00000	6.0800	0.5470	1.7527
287	24	20	0.0100000	0.	0.	1.00000	5.9800	1.1220	1.7527
288	25	20	0.0100000	0.	0.	1.00000	5.9800	1.0220	1.7527
289	26	20	0.0100000	0.	0.	1.00000	5.9800	0.9220	1.7527
290	27	20	0.0100000	0.	0.	1.00000	5.9800	0.8220	1.7527
291	28	20	0.0100000	0.	0.	1.00000	5.9800	0.7220	1.7527
292	29	20	0.0100000	0.	0.	1.00000	5.9800	0.6220	1.7527
293	30	20	0.0072000	0.	0.	1.00000	5.9800	0.5360	1.7527
294	31	20	0.0100000	0.	0.	1.00000	5.8800	1.0810	1.7527
295	32	20	0.0100000	0.	0.	1.00000	5.8800	0.9810	1.7527
296	33	20	0.0100000	0.	0.	1.00000	5.8800	0.8810	1.7527
297	34	20	0.0100000	0.	0.	1.00000	5.8800	0.7810	1.7527
298	35	20	0.0100000	0.	0.	1.00000	5.8800	0.6810	1.7527
299	36	20	0.0121000	0.	0.	1.00000	5.8800	0.5710	1.7527
300	37	20	0.0100000	0.	0.	1.00000	5.7800	1.0290	1.7527
301	38	20	0.0100000	0.	0.	1.00000	5.7800	0.9290	1.7527
302	39	20	0.0100000	0.	0.	1.00000	5.7800	0.8290	1.7527
303	40	20	0.0100000	0.	0.	1.00000	5.7800	0.7290	1.7527
304	41	20	0.0100000	0.	0.	1.00000	5.7800	0.6290	1.7527
305	42	20	0.0052900	0.	0.	1.00000	5.7800	0.5590	1.7527
306	43	20	0.0100000	0.	0.	1.00000	5.6800	0.9650	1.7527
307	44	20	0.0100000	0.	0.	1.00000	5.6800	0.8650	1.7527
308	45	20	0.0100000	0.	0.	1.00000	5.6800	0.7650	1.7527
309	46	20	0.0100000	0.	0.	1.00000	5.6800	0.6650	1.7527
310	47	20	0.0095000	0.	0.	1.00000	5.6800	0.5680	1.7527
311	48	20	0.0100000	0.	0.	1.00000	5.5800	0.8860	1.7527
312	49	20	0.0100000	0.	0.	1.00000	5.5800	0.7860	1.7527
313	50	20	0.0100000	0.	0.	1.00000	5.5800	0.6860	1.7527
314	51	20	0.0097000	0.	0.	1.00000	5.5800	0.5880	1.7527
315	52	20	0.0100000	0.	0.	1.00000	5.4800	0.8000	1.7527
316	53	20	0.0100000	0.	0.	1.00000	5.4800	0.7000	1.7527
317	54	20	0.0102000	0.	0.	1.00000	5.4800	0.5990	1.7527
318	55	20	0.0100000	0.	0.	1.00000	5.3800	0.6910	1.7527
319	56	20	0.0083000	0.	0.	1.00000	5.3800	0.6000	1.7527
320	57	20	0.0013900	0.	0.	1.00000	5.3142	0.5860	1.7527
321	1	21	0.0100000	0.	0.	1.00000	6.2800	-1.1890	1.7527
322	2	21	0.0100000	0.	0.	1.00000	6.2800	-1.0890	1.7527
323	3	21	0.0100000	0.	0.	1.00000	6.2800	-0.9890	1.7527
324	4	21	0.0100000	0.	0.	1.00000	6.2800	-0.8890	1.7527
325	5	21	0.0100000	0.	0.	1.00000	6.2800	-0.7890	1.7527
326	6	21	0.0100000	0.	0.	1.00000	6.2800	-0.6890	1.7527
327	7	21	0.0100000	0.	0.	1.00000	6.2800	-0.5890	1.7527
328	8	21	0.0067000	0.	0.	1.00000	6.2800	-0.5055	1.7527
329	9	21	0.0100000	0.	0.	1.00000	6.1800	-1.1750	1.7527

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
330	10	21	0.0100000	0.	0.	1.00000	6.1800	-1.0750	1.7527
331	11	21	0.0100000	0.	0.	1.00000	6.1800	-0.9750	1.7527
332	12	21	0.0100000	0.	0.	1.00000	6.1800	-0.8750	1.7527
333	13	21	0.0100000	0.	0.	1.00000	6.1800	-0.7750	1.7527
334	14	21	0.0100000	0.	0.	1.00000	6.1800	-0.6750	1.7527
335	15	21	0.0100000	0.	0.	1.00000	6.1800	-0.5750	1.7527
336	16	21	0.0044000	0.	0.	1.00000	6.1800	-0.5030	1.7527
337	17	21	0.0100000	0.	0.	1.00000	6.0800	-1.1530	1.7527
338	18	21	0.0100000	0.	0.	1.00000	6.0800	-1.0530	1.7527
339	19	21	0.0100000	0.	0.	1.00000	6.0800	-0.9530	1.7527
340	20	21	0.0100000	0.	0.	1.00000	6.0800	-0.8530	1.7527
341	21	21	0.0100000	0.	0.	1.00000	6.0800	-0.7530	1.7527
342	22	21	0.0100000	0.	0.	1.00000	6.0800	-0.6530	1.7527
343	23	21	0.0112000	0.	0.	1.00000	6.0800	-0.5470	1.7527
344	24	21	0.0100000	0.	0.	1.00000	5.9800	-1.1220	1.7527
345	25	21	0.0100000	0.	0.	1.00000	5.9800	-1.0220	1.7527
346	26	21	0.0100000	0.	0.	1.00000	5.9800	-0.9220	1.7527
347	27	21	0.0100000	0.	0.	1.00000	5.9800	-0.8220	1.7527
348	28	21	0.0100000	0.	0.	1.00000	5.9800	-0.7220	1.7527
349	29	21	0.0100000	0.	0.	1.00000	5.9800	-0.6220	1.7527
350	30	21	0.0072000	0.	0.	1.00000	5.9800	-0.5360	1.7527
351	31	21	0.0100000	0.	0.	1.00000	5.8800	-1.0810	1.7527
352	32	21	0.0100000	0.	0.	1.00000	5.8800	-0.9810	1.7527
353	33	21	0.0100000	0.	0.	1.00000	5.8800	-0.8810	1.7527
354	34	21	0.0100000	0.	0.	1.00000	5.8800	-0.7810	1.7527
355	35	21	0.0100000	0.	0.	1.00000	5.8800	-0.6810	1.7527
356	36	21	0.0121000	0.	0.	1.00000	5.8800	-0.5710	1.7527
357	37	21	0.0100000	0.	0.	1.00000	5.7800	-1.0290	1.7527
358	38	21	0.0100000	0.	0.	1.00000	5.7800	-0.9290	1.7527
359	39	21	0.0100000	0.	0.	1.00000	5.7800	-0.8290	1.7527
360	40	21	0.0100000	0.	0.	1.00000	5.7800	-0.7290	1.7527
361	41	21	0.0100000	0.	0.	1.00000	5.7800	-0.6290	1.7527
362	42	21	0.0052900	0.	0.	1.00000	5.7800	-0.5590	1.7527
363	43	21	0.0100000	0.	0.	1.00000	5.6800	-0.9650	1.7527
364	44	21	0.0100000	0.	0.	1.00000	5.6800	-0.8650	1.7527
365	45	21	0.0100000	0.	0.	1.00000	5.6800	-0.7650	1.7527
366	46	21	0.0100000	0.	0.	1.00000	5.6800	-0.6650	1.7527
367	47	21	0.0095000	0.	0.	1.00000	5.6800	-0.5680	1.7527
368	48	21	0.0100000	0.	0.	1.00000	5.5800	-0.8860	1.7527
369	49	21	0.0100000	0.	0.	1.00000	5.5800	-0.7860	1.7527
370	50	21	0.0100000	0.	0.	1.00000	5.5800	-0.6860	1.7527
371	51	21	0.0097000	0.	0.	1.00000	5.5800	-0.5880	1.7527
372	52	21	0.0100000	0.	0.	1.00000	5.4800	-0.8000	1.7527
373	53	21	0.0100000	0.	0.	1.00000	5.4800	-0.7000	1.7527
374	54	21	0.0102000	0.	0.	1.00000	5.4800	-0.5990	1.7527
375	55	21	0.0100000	0.	0.	1.00000	5.3800	-0.6910	1.7527
376	56	21	0.0083000	0.	0.	1.00000	5.3800	-0.6000	1.7527

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM			
				I	J	K	X	Y	Z	
377	57	21	0.0013900	0.	0.	1.00000	5.3142	-0.5860	1.7527	
378	1	22	0.0100000	0.	0.	1.00000	6.4016	1.4200	0.7370	
379	2	22	0.0125400	0.	0.	1.00000	6.4016	1.3073	0.7370	
380	3	22	0.0100000	0.	0.	1.00000	6.3016	1.5580	0.7370	
381	4	22	0.0100000	0.	0.	1.00000	6.3016	1.4580	0.7370	
382	5	22	0.0100000	0.	0.	1.00000	6.3016	1.3580	0.7370	
383	6	22	0.0067410	0.	0.	1.00000	6.3016	1.2743	0.7370	
384	7	22	0.0100000	0.	0.	1.00000	6.2016	1.6460	0.7370	
385	8	22	0.0100000	0.	0.	1.00000	6.2016	1.5460	0.7370	
386	9	22	0.0100000	0.	0.	1.00000	6.2016	1.4460	0.7370	
387	10	22	0.0100000	0.	0.	1.00000	6.2016	1.3460	0.7370	
388	11	22	0.0067590	0.	0.	1.00000	6.2016	1.2622	0.7370	
389	12	22	0.0100000	0.	0.	1.00000	6.1016	1.7070	0.7370	
390	13	22	0.0100000	0.	0.	1.00000	6.1016	1.6070	0.7370	
391	14	22	0.0100000	0.	0.	1.00000	6.1016	1.5070	0.7370	
392	15	22	0.0100000	0.	0.	1.00000	6.1016	1.4070	0.7370	
393	16	22	0.0149110	0.	0.	1.00000	6.1016	1.2824	0.7370	
394	17	22	0.0100000	0.	0.	1.00000	6.1016	1.7470	0.7370	
395	18	22	0.0100000	0.	0.	1.00000	6.1016	1.6470	0.7370	
396	19	22	0.0100000	0.	0.	1.00000	6.1016	1.5470	0.7370	
397	20	22	0.0100000	0.	0.	1.00000	6.1016	1.4470	0.7370	
398	21	22	0.0100000	0.	0.	1.00000	6.1016	1.3470	0.7370	
399	22	22	0.0118020	0.	0.	1.00000	6.0016	1.2380	0.7370	
400	23	22	0.0100000	0.	0.	1.00000	5.9016	1.7710	0.7370	
401	24	22	0.0100000	0.	0.	1.00000	5.9016	1.6710	0.7370	
402	25	22	0.0100000	0.	0.	1.00000	5.9016	1.5710	0.7370	
403	26	22	0.0100000	0.	0.	1.00000	5.9016	1.4710	0.7370	
404	27	22	0.0100000	0.	0.	1.00000	5.9016	1.3710	0.7370	
405	28	22	0.0100000	0.	0.	1.00000	5.9016	1.2710	0.7370	
406	29	22	0.0070820	0.	0.	1.00000	5.9016	1.1856	0.7370	
407	30	22	0.0100000	0.	0.	1.00000	5.8016	1.7790	0.7370	
408	31	22	0.0100000	0.	0.	1.00000	5.8016	1.6790	0.7370	
409	32	22	0.0100000	0.	0.	1.00000	5.8016	1.5790	0.7370	
410	33	22	0.0100000	0.	0.	1.00000	5.8016	1.4790	0.7370	
411	34	22	0.0100000	0.	0.	1.00000	5.8016	1.3790	0.7370	
412	35	22	0.0100000	0.	0.	1.00000	5.8016	1.2790	0.7370	
413	36	22	0.0138130	0.	0.	1.00000	5.8016	1.1599	0.7370	
414	37	22	0.0100000	0.	0.	1.00000	5.7016	1.7740	0.7370	
415	38	22	0.0100000	0.	0.	1.00000	5.7016	1.6740	0.7370	
416	39	22	0.0100000	0.	0.	1.00000	5.7016	1.5740	0.7370	
417	40	22	0.0100000	0.	0.	1.00000	5.7016	1.4740	0.7370	
418	41	22	0.0100000	0.	0.	1.00000	5.7016	1.3740	0.7370	
419	42	22	0.0100000	0.	0.	1.00000	5.7016	1.2740	0.7370	
420	43	22	0.0100000	0.	0.	1.00000	5.7016	1.1740	0.7370	
421	44	22	0.0094440	0.	0.	1.00000	5.7016	1.0768	0.7370	
422	45	22	0.0100000	0.	0.	1.00000	5.6016	1.7530	0.7370	
423	46	22	0.0100000	0.	0.	1.00000	5.6016	1.6530	0.7370	

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
424	47	22	0.0100000	0.	0.	1.00000	5.6016	1.5530	0.7370
425	48	22	0.0100000	0.	0.	1.00000	5.6016	1.4530	0.7370
426	49	22	0.0100000	0.	0.	1.00000	5.6016	1.3530	0.7370
427	50	22	0.0100000	0.	0.	1.00000	5.6016	1.2530	0.7370
428	51	22	0.0100000	0.	0.	1.00000	5.6016	1.1530	0.7370
429	52	22	0.0100000	0.	0.	1.00000	5.6016	1.0530	0.7370
430	53	22	0.0049070	0.	0.	1.00000	5.6016	0.9785	0.7370
431	54	22	0.0100000	0.	0.	1.00000	5.5016	1.7170	0.7370
432	55	22	0.0100000	0.	0.	1.00000	5.5016	1.6170	0.7370
433	56	22	0.0100000	0.	0.	1.00000	5.5016	1.5170	0.7370
434	57	22	0.0100000	0.	0.	1.00000	5.5016	1.4170	0.7370
435	58	22	0.0100000	0.	0.	1.00000	5.5016	1.3170	0.7370
436	59	22	0.0100000	0.	0.	1.00000	5.5016	1.2170	0.7370
437	60	22	0.0100000	0.	0.	1.00000	5.5016	1.1170	0.7370
438	61	22	0.0100000	0.	0.	1.00000	5.5016	1.0170	0.7370
439	62	22	0.0106770	0.	0.	1.00000	5.5016	0.9136	0.7370
440	63	22	0.0100000	0.	0.	1.00000	5.4016	1.6610	0.7370
441	64	22	0.0100000	0.	0.	1.00000	5.4016	1.5610	0.7370
442	65	22	0.0100000	0.	0.	1.00000	5.4016	1.4610	0.7370
443	66	22	0.0100000	0.	0.	1.00000	5.4016	1.3610	0.7370
444	67	22	0.0100000	0.	0.	1.00000	5.4016	1.2610	0.7370
445	68	22	0.0100000	0.	0.	1.00000	5.4016	1.1610	0.7370
446	69	22	0.0100000	0.	0.	1.00000	5.4016	1.0610	0.7370
447	70	22	0.0100000	0.	0.	1.00000	5.4016	0.9610	0.7370
448	71	22	0.0100000	0.	0.	1.00000	5.4016	0.8610	0.7370
449	72	22	0.0068710	0.	0.	1.00000	5.4016	0.7766	0.7370
450	73	22	0.0100000	0.	0.	1.00000	5.3016	1.5580	0.7370
451	74	22	0.0100000	0.	0.	1.00000	5.3016	1.4800	0.7370
452	75	22	0.0100000	0.	0.	1.00000	5.3016	1.3800	0.7370
453	76	22	0.0100000	0.	0.	1.00000	5.3016	1.2800	0.7370
454	77	22	0.0100000	0.	0.	1.00000	5.3016	1.1800	0.7370
455	78	22	0.0100000	0.	0.	1.00000	5.3016	1.0800	0.7370
456	79	22	0.0100000	0.	0.	1.00000	5.3016	0.9800	0.7370
457	80	22	0.0100000	0.	0.	1.00000	5.3016	0.8800	0.7370
458	81	22	0.0100000	0.	0.	1.00000	5.3016	0.7800	0.7370
459	82	22	0.0146050	0.	0.	1.00000	5.3016	0.6570	0.7370
460	83	22	0.0100000	0.	0.	1.00000	5.2016	1.4560	0.7370
461	84	22	0.0100000	0.	0.	1.00000	5.2016	1.3560	0.7370
462	85	22	0.0100000	0.	0.	1.00000	5.2016	1.2560	0.7370
463	86	22	0.0100000	0.	0.	1.00000	5.2016	1.1560	0.7370
464	87	22	0.0100000	0.	0.	1.00000	5.2016	1.0560	0.7370
465	88	22	0.0100000	0.	0.	1.00000	5.2016	0.9560	0.7370
466	89	22	0.0100000	0.	0.	1.00000	5.2016	0.8560	0.7370
467	90	22	0.0050000	0.	0.	1.00000	5.2016	0.7810	0.7370
468	91	22	0.0078300	0.	0.	1.00000	5.1233	1.2860	0.7370
469	92	22	0.0078300	0.	0.	1.00000	5.1233	1.1860	0.7370
470	93	22	0.0078300	0.	0.	1.00000	5.1233	1.0860	0.7370

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
471	94	22	0.0086130	0.	0.	1.00000	5.1233	0.9810	0.7370
472	1	23	0.0100000	0.	0.	1.00000	6.4500	-1.6510	0.7370
473	2	23	0.0100000	0.	0.	1.00000	6.4500	-1.7510	0.7370
474	3	23	0.0100000	0.	0.	1.00000	6.4500	-1.8510	0.7370
475	4	23	0.0109000	0.	0.	1.00000	6.4500	-1.9600	0.7370
476	5	23	0.0100000	0.	0.	1.00000	6.3500	-1.2935	0.7370
477	6	23	0.0100000	0.	0.	1.00000	6.3500	-1.3935	0.7370
478	7	23	0.0100000	0.	0.	1.00000	6.3500	-1.4935	0.7370
479	8	23	0.0100000	0.	0.	1.00000	6.3500	-1.5935	0.7370
480	9	23	0.0100000	0.	0.	1.00000	6.3500	-1.6935	0.7370
481	10	23	0.0100000	0.	0.	1.00000	6.3500	-1.7935	0.7370
482	11	23	0.0100000	0.	0.	1.00000	6.3500	-1.8935	0.7370
483	12	23	0.0100000	0.	0.	1.00000	6.3500	-1.9935	0.7370
484	13	23	0.0100000	0.	0.	1.00000	6.3500	-2.0935	0.7370
485	14	23	0.0089000	0.	0.	1.00000	6.3500	-2.1880	0.7370
486	15	23	0.0100000	0.	0.	1.00000	6.2500	-1.2854	0.7370
487	16	23	0.0100000	0.	0.	1.00000	6.2500	-1.3854	0.7370
488	17	23	0.0100000	0.	0.	1.00000	6.2500	-1.4854	0.7370
489	18	23	0.0100000	0.	0.	1.00000	6.2500	-1.5854	0.7370
490	19	23	0.0100000	0.	0.	1.00000	6.2500	-1.6854	0.7370
491	20	23	0.0100000	0.	0.	1.00000	6.2500	-1.7854	0.7370
492	21	23	0.0100000	0.	0.	1.00000	6.2500	-1.8854	0.7370
493	22	23	0.0100000	0.	0.	1.00000	6.2500	-1.9854	0.7370
494	23	23	0.0100000	0.	0.	1.00000	6.2500	-2.0854	0.7370
495	24	23	0.0100000	0.	0.	1.00000	6.2500	-2.1854	0.7370
496	25	23	0.0030000	0.	0.	1.00000	6.2500	-2.2504	0.7370
497	26	23	0.0100000	0.	0.	1.00000	6.1500	-1.2690	0.7370
498	27	23	0.0100000	0.	0.	1.00000	6.1500	-1.3690	0.7370
499	28	23	0.0100000	0.	0.	1.00000	6.1500	-1.4690	0.7370
500	29	23	0.0100000	0.	0.	1.00000	6.1500	-1.5690	0.7370
501	30	23	0.0100000	0.	0.	1.00000	6.1500	-1.6690	0.7370
502	31	23	0.0100000	0.	0.	1.00000	6.1500	-1.7690	0.7370
503	32	23	0.0100000	0.	0.	1.00000	6.1500	-1.8690	0.7370
504	33	23	0.0100000	0.	0.	1.00000	6.1500	-1.9690	0.7370
505	34	23	0.0100000	0.	0.	1.00000	6.1500	-2.0690	0.7370
506	35	23	0.0050000	0.	0.	1.00000	6.1500	-2.1440	0.7370
507	36	23	0.0050000	0.	0.	1.00000	6.1500	-2.1940	0.7370
508	37	23	0.0029000	0.	0.	1.00000	6.1500	-2.2340	0.7370
509	38	23	0.0100000	0.	0.	1.00000	6.0500	-1.2441	0.7370
510	39	23	0.0100000	0.	0.	1.00000	6.0500	-1.3441	0.7370
511	40	23	0.0100000	0.	0.	1.00000	6.0500	-1.4441	0.7370
512	41	23	0.0100000	0.	0.	1.00000	6.0500	-1.5441	0.7370
513	42	23	0.0100000	0.	0.	1.00000	6.0500	-1.6441	0.7370
514	43	23	0.0100000	0.	0.	1.00000	6.0500	-1.7441	0.7370
515	44	23	0.0100000	0.	0.	1.00000	6.0500	-1.8441	0.7370
516	45	23	0.0100000	0.	0.	1.00000	6.0500	-1.9441	0.7370
517	46	23	0.0100000	0.	0.	1.00000	6.0500	-2.0441	0.7370

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
518	47	23	0.0050000	0.	0.	1.00000	6.0500	-2.1191	0.7370
519	48	23	0.0050000	0.	0.	1.00000	6.0500	-2.1691	0.7370
520	49	23	0.0050000	0.	0.	1.00000	6.0500	-2.2191	0.7370
521	50	23	0.0028900	0.	0.	1.00000	6.0500	-2.2585	0.7370
522	51	23	0.0100000	0.	0.	1.00000	5.9500	-1.2100	0.7370
523	52	23	0.0100000	0.	0.	1.00000	5.9500	-1.3100	0.7370
524	53	23	0.0100000	0.	0.	1.00000	5.9500	-1.4100	0.7370
525	54	23	0.0100000	0.	0.	1.00000	5.9500	-1.5100	0.7370
526	55	23	0.0100000	0.	0.	1.00000	5.9500	-1.6100	0.7370
527	56	23	0.0100000	0.	0.	1.00000	5.9500	-1.7100	0.7370
528	57	23	0.0050000	0.	0.	1.00000	5.9500	-1.7850	0.7370
529	58	23	0.0050000	0.	0.	1.00000	5.9500	-1.8350	0.7370
530	59	23	0.0050000	0.	0.	1.00000	5.9500	-1.8850	0.7370
531	60	23	0.0050000	0.	0.	1.00000	5.9500	-1.9350	0.7370
532	61	23	0.0050000	0.	0.	1.00000	5.9500	-1.9850	0.7370
533	62	23	0.0213000	0.	0.	1.00000	5.9500	-2.0350	0.7370
534	63	23	0.0100000	0.	0.	1.00000	5.9500	-2.1665	0.7370
535	64	23	0.0100000	0.	0.	1.00000	5.8500	-1.1660	0.7370
536	65	23	0.0100000	0.	0.	1.00000	5.8500	-1.2660	0.7370
537	66	23	0.0100000	0.	0.	1.00000	5.8500	-1.3660	0.7370
538	67	23	0.0100000	0.	0.	1.00000	5.8500	-1.4660	0.7370
539	68	23	0.0100000	0.	0.	1.00000	5.8500	-1.5660	0.7370
540	69	23	0.0100000	0.	0.	1.00000	5.8500	-1.6660	0.7370
541	70	23	0.0100000	0.	0.	1.00000	5.8500	-1.7660	0.7370
542	71	23	0.0050000	0.	0.	1.00000	5.8500	-1.8410	0.7370
543	72	23	0.0050000	0.	0.	1.00000	5.8500	-1.8910	0.7370
544	73	23	0.0050000	0.	0.	1.00000	5.8500	-1.9410	0.7370
545	74	23	0.0050000	0.	0.	1.00000	5.8500	-1.9910	0.7370
546	75	23	0.0050000	0.	0.	1.00000	5.8500	-2.0410	0.7370
547	76	23	0.0050000	0.	0.	1.00000	5.8500	-2.0910	0.7370
548	77	23	0.0157000	0.	0.	1.00000	5.8500	-2.1940	0.7370
549	78	23	0.0100000	0.	0.	1.00000	5.7500	-1.1110	0.7370
550	79	23	0.0100000	0.	0.	1.00000	5.7500	-1.2110	0.7370
551	80	23	0.0100000	0.	0.	1.00000	5.7500	-1.3110	0.7370
552	81	23	0.0100000	0.	0.	1.00000	5.7500	-1.4110	0.7370
553	82	23	0.0100000	0.	0.	1.00000	5.7500	-1.5110	0.7370
554	83	23	0.0100000	0.	0.	1.00000	5.7500	-1.6110	0.7370
555	84	23	0.0100000	0.	0.	1.00000	5.7500	-1.7110	0.7370
556	85	23	0.0100000	0.	0.	1.00000	5.7500	-1.8110	0.7370
557	86	23	0.0050000	0.	0.	1.00000	5.7500	-1.8860	0.7370
558	87	23	0.0050000	0.	0.	1.00000	5.7500	-1.9360	0.7370
559	88	23	0.0050000	0.	0.	1.00000	5.7500	-1.9860	0.7370
560	89	23	0.0050000	0.	0.	1.00000	5.7500	-2.0360	0.7370
561	90	23	0.0050000	0.	0.	1.00000	5.7500	-2.0860	0.7370
562	91	23	0.0162000	0.	0.	1.00000	5.7500	-2.1920	0.7370
563	92	23	0.0100000	0.	0.	1.00000	5.6500	-1.0420	0.7370
564	93	23	0.0100000	0.	0.	1.00000	5.6500	-1.1420	0.7370

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
565	94	23	0.0100000	0.	0.	1.00000	5.6500	-1.2420	0.7370
566	95	23	0.0100000	0.	0.	1.00000	5.6500	-1.3420	0.7370
567	96	23	0.0100000	0.	0.	1.00000	5.6500	-1.4420	0.7370
568	97	23	0.0100000	0.	0.	1.00000	5.6500	-1.5420	0.7370
569	98	23	0.0100000	0.	0.	1.00000	5.6500	-1.6420	0.7370
570	99	23	0.0100000	0.	0.	1.00000	5.6500	-1.7420	0.7370
571	100	23	0.0100000	0.	0.	1.00000	5.6500	-1.8420	0.7370
572	101	23	0.0050000	0.	0.	1.00000	5.6500	-1.9170	0.7370
573	102	23	0.0050000	0.	0.	1.00000	5.6500	-1.9670	0.7370
574	103	23	0.0050000	0.	0.	1.00000	5.6500	-2.0170	0.7370
575	104	23	0.0050000	0.	0.	1.00000	5.6500	-2.0670	0.7370
576	105	23	0.0050000	0.	0.	1.00000	5.6500	-2.1170	0.7370
577	106	23	0.0131000	0.	0.	1.00000	5.6500	-2.1980	0.7370
578	107	23	0.0100000	0.	0.	1.00000	5.5500	-0.9580	0.7370
579	108	23	0.0100000	0.	0.	1.00000	5.5500	-1.0580	0.7370
580	109	23	0.0100000	0.	0.	1.00000	5.5500	-1.1580	0.7370
581	110	23	0.0100000	0.	0.	1.00000	5.5500	-1.2580	0.7370
582	111	23	0.0100000	0.	0.	1.00000	5.5500	-1.3580	0.7370
583	112	23	0.0100000	0.	0.	1.00000	5.5500	-1.4580	0.7370
584	113	23	0.0100000	0.	0.	1.00000	5.5500	-1.5580	0.7370
585	114	23	0.0100000	0.	0.	1.00000	5.5500	-1.6580	0.7370
586	115	23	0.0100000	0.	0.	1.00000	5.5500	-1.7580	0.7370
587	116	23	0.0100000	0.	0.	1.00000	5.5500	-1.8580	0.7370
588	117	23	0.0050000	0.	0.	1.00000	5.5500	-1.9330	0.7370
589	118	23	0.0050000	0.	0.	1.00000	5.5500	-1.9830	0.7370
590	119	23	0.0050000	0.	0.	1.00000	5.5500	-2.0330	0.7370
591	120	23	0.0050000	0.	0.	1.00000	5.5500	-2.0830	0.7370
592	121	23	0.0050000	0.	0.	1.00000	5.5500	-2.1330	0.7370
593	122	23	0.0116000	0.	0.	1.00000	5.5500	-2.2160	0.7370
594	123	23	0.0100000	0.	0.	1.00000	5.4500	-0.8530	0.7370
595	124	23	0.0100000	0.	0.	1.00000	5.4500	-0.9530	0.7370
596	125	23	0.0100000	0.	0.	1.00000	5.4500	-1.0530	0.7370
597	126	23	0.0100000	0.	0.	1.00000	5.4500	-1.1530	0.7370
598	127	23	0.0100000	0.	0.	1.00000	5.4500	-1.2530	0.7370
599	128	23	0.0100000	0.	0.	1.00000	5.4500	-1.3530	0.7370
600	129	23	0.0100000	0.	0.	1.00000	5.4500	-1.4530	0.7370
601	130	23	0.0100000	0.	0.	1.00000	5.4500	-1.5530	0.7370
602	131	23	0.0100000	0.	0.	1.00000	5.4500	-1.6530	0.7370
603	132	23	0.0100000	0.	0.	1.00000	5.4500	-1.7530	0.7370
604	133	23	0.0050000	0.	0.	1.00000	5.4500	-1.8280	0.7370
605	134	23	0.0050000	0.	0.	1.00000	5.4500	-1.8780	0.7370
606	135	23	0.0050000	0.	0.	1.00000	5.4500	-1.9280	0.7370
607	136	23	0.0050000	0.	0.	1.00000	5.4500	-1.9780	0.7370
608	137	23	0.0050000	0.	0.	1.00000	5.4500	-2.0280	0.7370
609	138	23	0.0220000	0.	0.	1.00000	5.4500	-2.1630	0.7370
610	139	23	0.0100000	0.	0.	1.00000	5.3500	-0.7170	0.7370
611	140	23	0.0100000	0.	0.	1.00000	5.3500	-0.8170	0.7370

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
612	141	23	0.0100000	0.	0.	1.00000	5.3500	-0.9170	0.7370
613	142	23	0.0100000	0.	0.	1.00000	5.3500	-1.0170	0.7370
614	143	23	0.0100000	0.	0.	1.00000	5.3500	-1.1170	0.7370
615	144	23	0.0100000	0.	0.	1.00000	5.3500	-1.2170	0.7370
616	145	23	0.0100000	0.	0.	1.00000	5.3500	-1.3170	0.7370
617	146	23	0.0100000	0.	0.	1.00000	5.3500	-1.4170	0.7370
618	147	23	0.0100000	0.	0.	1.00000	5.3500	-1.5170	0.7370
619	148	23	0.0100000	0.	0.	1.00000	5.3500	-1.6170	0.7370
620	149	23	0.0100000	0.	0.	1.00000	5.3500	-1.7170	0.7370
621	150	23	0.0100000	0.	0.	1.00000	5.3500	-1.8170	0.7370
622	151	23	0.0050000	0.	0.	1.00000	5.3500	-1.8920	0.7370
623	152	23	0.0050000	0.	0.	1.00000	5.3500	-1.9420	0.7370
624	153	23	0.0050000	0.	0.	1.00000	5.3500	-1.9920	0.7370
625	154	23	0.0050000	0.	0.	1.00000	5.3500	-2.0420	0.7370
626	155	23	0.0203000	0.	0.	1.00000	5.3500	-2.1680	0.7370
627	156	23	0.0100000	0.	0.	1.00000	5.2500	-1.1860	0.7370
628	157	23	0.0100000	0.	0.	1.00000	5.2500	-1.2860	0.7370
629	158	23	0.0100000	0.	0.	1.00000	5.2500	-1.3860	0.7370
630	159	23	0.0100000	0.	0.	1.00000	5.2500	-1.4860	0.7370
631	160	23	0.0100000	0.	0.	1.00000	5.2500	-1.5860	0.7370
632	161	23	0.0100000	0.	0.	1.00000	5.2500	-1.6860	0.7370
633	162	23	0.0100000	0.	0.	1.00000	5.2500	-1.7860	0.7370
634	163	23	0.0100000	0.	0.	1.00000	5.2500	-1.8860	0.7370
635	164	23	0.0100000	0.	0.	1.00000	5.2500	-1.9860	0.7370
636	165	23	0.0100000	0.	0.	1.00000	5.2500	-2.0860	0.7370
637	166	23	0.0116000	0.	0.	1.00000	5.2500	-2.1940	0.7370
638	167	23	0.0094500	0.	0.	1.00000	5.1555	-1.5360	0.7370
639	168	23	0.0094500	0.	0.	1.00000	5.1555	-1.6360	0.7370
640	169	23	0.0094500	0.	0.	1.00000	5.1555	-1.7360	0.7370
641	170	23	0.0094500	0.	0.	1.00000	5.1555	-1.8360	0.7370
642	171	23	0.0094500	0.	0.	1.00000	5.1555	-1.9360	0.7370
643	172	23	0.0107700	0.	0.	1.00000	5.1555	-2.0430	0.7370
644	1	24	0.0955000	0.	0.86603	0.50000	7.8000	0.3480	0.8260
645	1	25	0.0955000	0.	-0.86603	0.50000	7.8000	-0.3480	0.8260
646	1	26	0.	0.70721	0.	0.70700			
647	1	27	0.	0.70721	0.	0.70700			
648	1	28	0.5000000	0.10934	0.99400	0.			
649	1	29	0.5000000	0.10934	-0.99400	0.			
650	1	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	0.6870
651	2	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	0.5870
652	3	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	0.4870
653	4	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	0.3870
654	5	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	0.2870
655	6	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	0.1870
656	7	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	0.0870
657	8	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	-0.0130
658	9	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	-0.1130



TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
659	10	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	-0.2130
660	11	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	-0.3130
661	12	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	-0.4130
662	13	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	-0.5130
663	14	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	-0.6130
664	15	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	-0.7130
665	16	30	0.0100000	0.	-1.00000	0.	7.4810	-1.3720	-0.8130
666	17	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	0.6870
667	18	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	0.5870
668	19	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	0.4870
669	20	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	0.3870
670	21	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	0.2870
671	22	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	0.1870
672	23	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	0.0870
673	24	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	-0.0130
674	25	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	-0.1130
675	26	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	-0.2130
676	27	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	-0.3130
677	28	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	-0.4130
678	29	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	-0.5130
679	30	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	-0.6130
680	31	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	-0.7130
681	32	30	0.0100000	0.	-1.00000	0.	7.3810	-1.3720	-0.8130
682	33	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	0.6870
683	34	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	0.5870
684	35	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	0.4870
685	36	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	0.3870
686	37	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	0.2870
687	38	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	0.1870
688	39	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	0.0870
689	40	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	-0.0130
690	41	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	-0.1130
691	42	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	-0.2130
692	43	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	-0.3130
693	44	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	-0.4130
694	45	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	-0.5130
695	46	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	-0.6130
696	47	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	-0.7130
697	48	30	0.0100000	0.	-1.00000	0.	7.2810	-1.3720	-0.8130
698	49	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	0.6870
699	50	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	0.5870
700	51	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	0.4870
701	52	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	0.3870
702	53	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	0.2870
703	54	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	0.1870
704	55	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	0.0870
705	56	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	-0.0130

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
706	57	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	-0.1130
707	58	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	-0.2130
708	59	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	-0.3130
709	60	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	-0.4130
710	61	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	-0.5130
711	62	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	-0.6130
712	63	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	-0.7130
713	64	30	0.0100000	0.	-1.00000	0.	7.1810	-1.3720	-0.8130
714	65	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	0.6870
715	66	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	0.5870
716	67	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	0.4870
717	68	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	0.3870
718	69	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	0.2870
719	70	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	0.1870
720	71	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	0.0870
721	72	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	-0.0130
722	73	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	-0.1130
723	74	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	-0.2130
724	75	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	-0.3130
725	76	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	-0.4130
726	77	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	-0.5130
727	78	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	-0.6130
728	79	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	-0.7130
729	80	30	0.0100000	0.	-1.00000	0.	7.0810	-1.3720	-0.8130
730	81	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	0.6870
731	82	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	0.5870
732	83	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	0.4870
733	84	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	0.3870
734	85	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	0.2870
735	86	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	0.1870
736	87	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	0.0870
737	88	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	-0.0130
738	89	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	-0.1130
739	90	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	-0.2130
740	91	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	-0.3130
741	92	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	-0.4130
742	93	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	-0.5130
743	94	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	-0.6130
744	95	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	-0.7130
745	96	30	0.0100000	0.	-1.00000	0.	6.9810	-1.3720	-0.8130
746	97	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	0.6870
747	98	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	0.5870
748	99	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	0.4870
749	100	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	0.3870
750	101	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	0.2870
751	102	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	0.1870
752	103	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	0.0870

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
753	104	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	-0.0130
754	105	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	-0.1130
755	106	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	-0.2130
756	107	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	-0.3130
757	108	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	-0.4130
758	109	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	-0.5130
759	110	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	-0.6130
760	111	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	-0.7130
761	112	30	0.0100000	0.	-1.00000	0.	6.8810	-1.3720	-0.8130
762	113	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	0.3870
763	114	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	0.5870
764	115	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	0.4870
765	116	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	0.3870
766	117	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	0.2870
767	118	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	0.1870
768	119	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	0.0870
769	120	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	-0.0130
770	121	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	-0.1130
771	122	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	-0.2130
772	123	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	-0.3130
773	124	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	-0.4130
774	125	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	-0.5130
775	126	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	-0.6130
776	127	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	-0.7130
777	128	30	0.0100000	0.	-1.00000	0.	6.7810	-1.3720	-0.8130
778	129	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	0.6870
779	130	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	0.5870
780	131	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	0.4870
781	132	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	0.3870
782	133	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	0.2870
783	134	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	0.1870
784	135	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	0.0870
785	136	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	-0.0130
786	137	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	-0.1130
787	138	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	-0.2130
788	139	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	-0.3130
789	140	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	-0.4130
790	141	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	-0.5130
791	142	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	-0.6130
792	143	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	-0.7130
793	144	30	0.0100000	0.	-1.00000	0.	6.6810	-1.3720	-0.8130
794	145	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	0.6870
795	146	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	0.5870
796	147	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	0.4870
797	148	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	0.3870
798	149	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	0.2870
799	150	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	0.1870

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
800	151	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	0.0870
801	152	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	-0.0130
802	153	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	-0.1130
803	154	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	-0.2130
804	155	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	-0.3130
805	156	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	-0.4130
806	157	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	-0.5130
807	158	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	-0.6130
808	159	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	-0.7130
809	160	30	0.0100000	0.	-1.00000	0.	6.5810	-1.3720	-0.8130
810	161	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	0.6870
811	162	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	0.5870
812	163	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	0.4870
813	164	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	0.3870
814	165	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	0.2870
815	166	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	0.1870
816	167	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	0.0870
817	168	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	-0.0130
818	169	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	-0.1130
819	170	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	-0.2130
820	171	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	-0.3130
821	172	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	-0.4130
822	173	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	-0.5130
823	174	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	-0.6130
824	175	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	-0.7130
825	176	30	0.0093000	0.	-1.00000	0.	6.4850	-1.3720	-0.8130
826	1	31	0.0140700	0.72084	-0.69310	0.	7.4690	-0.5636	-0.9140
827	2	31	0.0015500	0.72084	-0.69310	0.	7.4690	-0.5636	-0.9695
828	3	31	0.0140700	0.72084	-0.69310	0.	7.3690	-0.6626	-0.9140
829	4	31	0.0140700	0.72084	-0.69310	0.	7.3690	-0.6626	-1.0140
830	5	31	0.0185700	0.72084	-0.69310	0.	7.3690	-0.6626	-1.1300
831	6	31	0.0140700	0.72084	-0.69310	0.	7.2690	-0.7616	-0.9140
832	7	31	0.0140700	0.72084	-0.69310	0.	7.2690	-0.7616	-1.0140
833	8	31	0.0140700	0.72084	-0.69310	0.	7.2690	-0.7616	-1.1140
834	9	31	0.0140700	0.72084	-0.69310	0.	7.2690	-0.7616	-1.2140
835	10	31	0.0140700	0.72084	-0.69310	0.	7.2690	-0.7616	-1.3140
836	11	31	0.0078800	0.72084	-0.69310	0.	7.2690	-0.7616	-1.3920
837	12	31	0.0140700	0.72084	-0.69310	0.	7.1690	-0.8606	-0.9140
838	13	31	0.0140700	0.72084	-0.69310	0.	7.1690	-0.8606	-1.0140
839	14	31	0.0140700	0.72084	-0.69310	0.	7.1690	-0.8606	-1.1140
840	15	31	0.0140700	0.72084	-0.69310	0.	7.1690	-0.8606	-1.2140
841	16	31	0.0140700	0.72084	-0.69310	0.	7.1690	-0.8606	-1.3140
842	17	31	0.0140700	0.72084	-0.69310	0.	7.1690	-0.8606	-1.4140
843	18	31	0.0140700	0.72084	-0.69310	0.	7.1690	-0.8606	-1.5140
844	19	31	0.0111100	0.72084	-0.69310	0.	7.1690	-0.8606	-1.6040
845	20	31	0.0035200	0.72084	-0.69310	0.	7.1060	-0.9236	-0.9140
846	21	31	0.0035200	0.72084	-0.69310	0.	7.1060	-0.9236	-1.0140

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
847	22	31	0.0035200	0.72084	-0.69310	0.	7.1060	-0.9236	-1.1140
848	23	31	0.0035200	0.72084	-0.69310	0.	7.1060	-0.9236	-1.2140
849	24	31	0.0035200	0.72084	-0.69310	0.	7.1060	-0.9236	-1.3140
850	25	31	0.0035200	0.72084	-0.69310	0.	7.1060	-0.9236	-1.4140
851	26	31	0.0035200	0.72084	-0.69310	0.	7.1060	-0.9236	-1.5140
852	27	31	0.0035200	0.72084	-0.69310	0.	7.1060	-0.9236	-1.6140
853	28	31	0.0041900	0.72084	-0.69310	0.	7.1060	-0.9236	-1.7240
854	1	32	0.0108556	0.34202	-0.93969	0.	7.0440	-0.9560	-0.9140
855	2	32	0.0108556	0.34202	-0.93969	0.	7.0440	-0.9560	-1.0140
856	3	32	0.0108556	0.34202	-0.93969	0.	7.0440	-0.9560	-1.1140
857	4	32	0.0108556	0.34202	-0.93969	0.	7.0440	-0.9560	-1.2140
858	5	32	0.0108556	0.34202	-0.93969	0.	7.0440	-0.9560	-1.3140
859	6	32	0.0108556	0.34202	-0.93969	0.	7.0440	-0.9560	-1.4140
860	7	32	0.0108556	0.34202	-0.93969	0.	7.0440	-0.9560	-1.5140
861	8	32	0.0108556	0.34202	-0.93969	0.	7.0440	-0.9560	-1.6140
862	9	32	0.0055364	0.34202	-0.93969	0.	7.0440	-0.9560	-1.6900
863	10	32	0.0108556	0.34202	-0.93969	0.	6.9440	-0.9980	-0.9140
864	11	32	0.0108556	0.34202	-0.93969	0.	6.9440	-0.9980	-1.0140
865	12	32	0.0108556	0.34202	-0.93969	0.	6.9440	-0.9980	-1.1140
866	13	32	0.0108556	0.34202	-0.93969	0.	6.9440	-0.9980	-1.2140
867	14	32	0.0108556	0.34202	-0.93969	0.	6.9440	-0.9980	-1.3140
868	15	32	0.0108556	0.34202	-0.93969	0.	6.9440	-0.9980	-1.4140
869	16	32	0.0100957	0.34202	-0.93969	0.	6.9440	-0.9980	-1.5100
870	17	32	0.0108556	0.34202	-0.93969	0.	6.8440	-1.0400	-0.9140
871	18	32	0.0108556	0.34202	-0.93969	0.	6.8440	-1.0400	-1.0140
872	19	32	0.0108556	0.34202	-0.93969	0.	6.8440	-1.0400	-1.1140
873	20	32	0.0108556	0.34202	-0.93969	0.	6.8440	-1.0400	-1.2140
874	21	32	0.0134609	0.34202	-0.93969	0.	6.8440	-1.0400	-1.3260
875	22	32	0.0108556	0.34202	-0.93969	0.	6.7440	-1.0830	-0.9140
876	23	32	0.0108556	0.34202	-0.93969	0.	6.7440	-1.0830	-1.0140
877	24	32	0.0108556	0.34202	-0.93969	0.	6.7440	-1.0830	-1.1140
878	25	32	0.0059706	0.34202	-0.93969	0.	6.7440	-1.0830	-1.1920
879	26	32	0.0108556	0.34202	-0.93969	0.	6.6440	-1.1250	-0.9140
880	27	32	0.0094444	0.34202	-0.93969	0.	6.6440	-1.1250	-1.0080
881	28	32	0.0033110	0.34202	-0.93969	0.	6.5630	-1.1590	-0.8890
882	1	33	0.0100000	0.	0.	-1.00000	7.8880	-1.1080	-0.8640
883	2	33	0.0100000	0.	0.	-1.00000	7.8880	-1.0080	-0.8640
884	3	33	0.0100000	0.	0.	-1.00000	7.8880	-0.9080	-0.8640
885	4	33	0.0100000	0.	0.	-1.00000	7.8880	-0.8080	-0.8640
886	5	33	0.0100000	0.	0.	-1.00000	7.8880	-0.7080	-0.8640
887	6	33	0.0100000	0.	0.	-1.00000	7.8880	-0.6080	-0.8640
888	7	33	0.0120000	0.	0.	-1.00000	7.8880	-0.4980	-0.8640
889	8	33	0.0100000	0.	0.	-1.00000	7.7880	-1.2290	-0.8640
890	9	33	0.0100000	0.	0.	-1.00000	7.7880	-1.1290	-0.8640
891	10	33	0.0100000	0.	0.	-1.00000	7.7880	-1.0290	-0.8640
892	11	33	0.0100000	0.	0.	-1.00000	7.7880	-0.9290	-0.8640
893	12	33	0.0100000	0.	0.	-1.00000	7.7880	-0.8290	-0.8640

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE		
				I	J	K	X	Y	Z
894	13	33	0.0100000	0.	0.	-1.00000	7.7880	-0.7290	-0.8640
895	14	33	0.0100000	0.	0.	-1.00000	7.7880	-0.6290	-0.8640
896	15	33	0.0100000	0.	0.	-1.00000	7.7880	-0.5290	-0.8640
897	16	33	0.0041000	0.	0.	-1.00000	7.7880	-0.4580	-0.8640
898	17	33	0.0100000	0.	0.	-1.00000	7.6880	-1.2900	-0.8640
899	18	33	0.0100000	0.	0.	-1.00000	7.6880	-1.1900	-0.8640
900	19	33	0.0100000	0.	0.	-1.00000	7.6880	-1.0900	-0.8640
901	20	33	0.0100000	0.	0.	-1.00000	7.6880	-0.9900	-0.8640
902	21	33	0.0100000	0.	0.	-1.00000	7.6880	-0.8900	-0.8640
903	22	33	0.0100000	0.	0.	-1.00000	7.6880	-0.7900	-0.8640
904	23	33	0.0100000	0.	0.	-1.00000	7.6880	-0.6900	-0.8640
905	24	33	0.0100000	0.	0.	-1.00000	7.6880	-0.5900	-0.8640
906	25	33	0.0102000	0.	0.	-1.00000	7.6880	-0.4890	-0.8640
907	26	33	0.0100000	0.	0.	-1.00000	7.5880	-1.3170	-0.8640
908	27	33	0.0100000	0.	0.	-1.00000	7.5880	-1.2170	-0.8640
909	28	33	0.0100000	0.	0.	-1.00000	7.5880	-1.1170	-0.8640
910	29	33	0.0100000	0.	0.	-1.00000	7.5880	-1.0170	-0.8640
911	30	33	0.0100000	0.	0.	-1.00000	7.5880	-0.9170	-0.8640
912	31	33	0.0100000	0.	0.	-1.00000	7.5880	-0.8170	-0.8640
913	32	33	0.0100000	0.	0.	-1.00000	7.5880	-0.7170	-0.8640
914	33	33	0.0100000	0.	0.	-1.00000	7.5880	-0.6170	-0.8640
915	34	33	0.0129000	0.	0.	-1.00000	7.5880	-0.5020	-0.8640
916	35	33	0.0100000	0.	0.	-1.00000	7.4880	-1.3220	-0.8640
917	36	33	0.0100000	0.	0.	-1.00000	7.4880	-1.2220	-0.8640
918	37	33	0.0100000	0.	0.	-1.00000	7.4880	-1.1220	-0.8640
919	38	33	0.0100000	0.	0.	-1.00000	7.4880	-1.0220	-0.8640
920	39	33	0.0100000	0.	0.	-1.00000	7.4880	-0.9220	-0.8640
921	40	33	0.0100000	0.	0.	-1.00000	7.4880	-0.8220	-0.8640
922	41	33	0.0100000	0.	0.	-1.00000	7.4880	-0.7220	-0.8640
923	42	33	0.0100000	0.	0.	-1.00000	7.4880	-0.6220	-0.8640
924	43	33	0.0066000	0.	0.	-1.00000	7.4880	-0.5390	-0.8640
925	44	33	0.0100000	0.	0.	-1.00000	7.3880	-1.3220	-0.8640
926	45	33	0.0100000	0.	0.	-1.00000	7.3880	-1.2220	-0.8640
927	46	33	0.0100000	0.	0.	-1.00000	7.3880	-1.1220	-0.8640
928	47	33	0.0100000	0.	0.	-1.00000	7.3880	-1.0220	-0.8640
929	48	33	0.0100000	0.	0.	-1.00000	7.3880	-0.9220	-0.8640
930	49	33	0.0100000	0.	0.	-1.00000	7.3880	-0.8220	-0.8640
931	50	33	0.0100000	0.	0.	-1.00000	7.3880	-0.7220	-0.8640
932	51	33	0.0126500	0.	0.	-1.00000	7.3880	-0.6442	-0.8640
933	52	33	0.0100000	0.	0.	-1.00000	7.2880	-1.3220	-0.8640
934	53	33	0.0100000	0.	0.	-1.00000	7.2880	-1.2220	-0.8640
935	54	33	0.0100000	0.	0.	-1.00000	7.2880	-1.1220	-0.8640
936	55	33	0.0100000	0.	0.	-1.00000	7.2880	-1.0220	-0.8640
937	56	33	0.0100000	0.	0.	-1.00000	7.2880	-0.9220	-0.8640
938	57	33	0.0100000	0.	0.	-1.00000	7.2880	-0.8220	-0.8640
939	58	33	0.0045100	0.	0.	-1.00000	7.2880	-0.7494	-0.8640
940	59	33	0.0100000	0.	0.	-1.00000	7.1880	-1.3220	-0.8640

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM			
				I	J	K	X	Y	Z	
988	23	34	0.0100000	0.	0.	-1.00000	6.3400	-1.0740	-0.8640	
989	24	34	0.0089000	0.	0.	-1.00000	6.3400	-0.9800	-0.8640	
990	25	34	0.0100000	0.	0.	-1.00000	6.2400	-2.1740	-0.8640	
991	26	34	0.0100000	0.	0.	-1.00000	6.2400	-2.0740	-0.8640	
992	27	34	0.0100000	0.	0.	-1.00000	6.2400	-1.9740	-0.8640	
993	28	34	0.0100000	0.	0.	-1.00000	6.2400	-1.8740	-0.8640	
994	29	34	0.0100000	0.	0.	-1.00000	6.2400	-1.7740	-0.8640	
995	30	34	0.0100000	0.	0.	-1.00000	6.2400	-1.6740	-0.8640	
996	31	34	0.0100000	0.	0.	-1.00000	6.2400	-1.5740	-0.8640	
997	32	34	0.0100000	0.	0.	-1.00000	6.2400	-1.4740	-0.8640	
998	33	34	0.0100000	0.	0.	-1.00000	6.2400	-1.3740	-0.8640	
999	34	34	0.0100000	0.	0.	-1.00000	6.2400	-1.2740	-0.8640	
1000	35	34	0.0100000	0.	0.	-1.00000	6.2400	-1.1740	-0.8640	
1001	36	34	0.0100000	0.	0.	-1.00000	6.2400	-1.0740	-0.8640	
1002	37	34	0.0089000	0.	0.	-1.00000	6.2400	-0.9800	-0.8640	
1003	38	34	0.0100000	0.	0.	-1.00000	6.1400	-2.1740	-0.8640	
1004	39	34	0.0100000	0.	0.	-1.00000	6.1400	-2.0740	-0.8640	
1005	40	34	0.0100000	0.	0.	-1.00000	6.1400	-1.9740	-0.8640	
1006	41	34	0.0100000	0.	0.	-1.00000	6.1400	-1.8740	-0.8640	
1007	42	34	0.0100000	0.	0.	-1.00000	6.1400	-1.7790	-0.8640	
1008	43	34	0.0100000	0.	0.	-1.00000	6.1400	-1.6740	-0.8640	
1009	44	34	0.0100000	0.	0.	-1.00000	6.1400	-1.5740	-0.8640	
1010	45	34	0.0100000	0.	0.	-1.00000	6.1400	-1.4740	-0.8640	
1011	46	34	0.0100000	0.	0.	-1.00000	6.1400	-1.3740	-0.8640	
1012	47	34	0.0100000	0.	0.	-1.00000	6.1400	-1.2740	-0.8640	
1013	48	34	0.0100000	0.	0.	-1.00000	6.1400	-1.1740	-0.8640	
1014	49	34	0.0100000	0.	0.	-1.00000	6.1400	-1.0740	-0.8640	
1015	50	34	0.0089000	0.	0.	-1.00000	6.1400	-0.9800	-0.8640	
1016	51	34	0.0100000	0.	0.	-1.00000	6.0400	-2.1740	-0.8640	
1017	52	34	0.0100000	0.	0.	-1.00000	6.0400	-2.0740	-0.8640	
1018	53	34	0.0100000	0.	0.	-1.00000	6.0400	-1.9740	-0.8640	
1019	54	34	0.0100000	0.	0.	-1.00000	6.0400	-1.8740	-0.8640	
1020	55	34	0.0100000	0.	0.	-1.00000	6.0400	-1.7740	-0.8640	
1021	56	34	0.0100000	0.	0.	-1.00000	6.0400	-1.6740	-0.8640	
1022	57	34	0.0100000	0.	0.	-1.00000	6.0400	-1.5740	-0.8640	
1023	58	34	0.0100000	0.	0.	-1.00000	6.0400	-1.4740	-0.8640	
1024	59	34	0.0100000	0.	0.	-1.00000	6.0400	-1.3740	-0.8640	
1025	60	34	0.0100000	0.	0.	-1.00000	6.0400	-1.2740	-0.8640	
1026	61	34	0.0100000	0.	0.	-1.00000	6.0400	-1.1740	-0.8640	
1027	62	34	0.0100000	0.	0.	-1.00000	6.0400	-1.0740	-0.8640	
1028	63	34	0.0089000	0.	0.	-1.00000	6.0400	-0.9800	-0.8640	
1029	64	34	0.0100000	0.	0.	-1.00000	5.9400	-2.1740	-0.8640	
1030	65	34	0.0100000	0.	0.	-1.00000	5.9400	-2.0740	-0.8640	
1031	66	34	0.0100000	0.	0.	-1.00000	5.9400	-1.9740	-0.8640	
1032	67	34	0.0100000	0.	0.	-1.00000	5.9400	-1.8740	-0.8640	
1033	68	34	0.0100000	0.	0.	-1.00000	5.9400	-1.7740	-0.8640	
1034	69	34	0.0100000	0.	0.	-1.00000	5.9400	-1.6740	-0.8640	

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
941	60	33	0.0100000	0.	0.	-1.00000	7.1880	-1.2220	-0.8640
942	61	33	0.0100000	0.	0.	-1.00000	7.1880	-1.1220	-0.8640
943	62	33	0.0100000	0.	0.	-1.00000	7.1880	-1.0220	-0.8640
944	63	33	0.0134700	0.	0.	-1.00000	7.1880	-0.9046	-0.8640
945	64	33	0.0100000	0.	0.	-1.00000	7.0880	-1.3220	-0.8640
946	65	33	0.0100000	0.	0.	-1.00000	7.0880	-1.2220	-0.8640
947	66	33	0.0100000	0.	0.	-1.00000	7.0880	-1.1220	-0.8640
948	67	33	0.0100000	0.	0.	-1.00000	7.0880	-1.0220	-0.8640
949	68	33	0.0028000	0.	0.	-1.00000	7.0880	-0.9580	-0.8640
950	69	33	0.0100000	0.	0.	-1.00000	6.9880	-1.3220	-0.8640
951	70	33	0.0100000	0.	0.	-1.00000	6.9880	-1.2220	-0.8640
952	71	33	0.0100000	0.	0.	-1.00000	6.9880	-1.1220	-0.8640
953	72	33	0.0100000	0.	0.	-1.00000	6.9880	-1.0220	-0.8640
954	73	33	0.0028000	0.	0.	-1.00000	6.9880	-0.9580	-0.8640
955	74	33	0.0100000	0.	0.	-1.00000	6.8880	-1.3220	-0.8640
956	75	33	0.0100000	0.	0.	-1.00000	6.8880	-1.2220	-0.8640
957	76	33	0.0100000	0.	0.	-1.00000	6.8880	-1.1220	-0.8640
958	77	33	0.0070000	0.	0.	-1.00000	6.8880	-1.0370	-0.8640
959	78	33	0.0100000	0.	0.	-1.00000	6.7880	-1.3220	-0.8640
960	79	33	0.0100000	0.	0.	-1.00000	6.7880	-1.2220	-0.8640
961	80	33	0.0085000	0.	0.	-1.00000	6.7880	-1.1295	-0.8640
962	81	33	0.0100000	0.	0.	-1.00000	6.6880	-1.3220	-0.8640
963	82	33	0.0100000	0.	0.	-1.00000	6.6880	-1.2220	-0.8640
964	83	33	0.0116000	0.	0.	-1.00000	6.5880	-1.3140	-0.8640
965	84	33	0.0030710	0.	0.	-1.00000	6.4950	-1.3535	-0.8640
966	1	34	0.0100000	0.	0.	-1.00000	6.4400	-2.0180	-0.8640
967	2	34	0.0100000	0.	0.	-1.00000	6.4400	-1.9180	-0.8640
968	3	34	0.0100000	0.	0.	-1.00000	6.4400	-1.8180	-0.8640
969	4	34	0.0100000	0.	0.	-1.00000	6.4400	-1.7180	-0.8640
970	5	34	0.0100000	0.	0.	-1.00000	6.4400	-1.6180	-0.8640
971	6	34	0.0100000	0.	0.	-1.00000	6.4400	-1.5180	-0.8640
972	7	34	0.0100000	0.	0.	-1.00000	6.4400	-1.4180	-0.8640
973	8	34	0.0100000	0.	0.	-1.00000	6.4400	-1.3180	-0.8640
974	9	34	0.0100000	0.	0.	-1.00000	6.4400	-1.2180	-0.8640
975	10	34	0.0100000	0.	0.	-1.00000	6.4400	-1.1180	-0.8640
976	11	34	0.0133000	0.	0.	-1.00000	6.4400	-1.0020	-0.8640
977	12	34	0.0100000	0.	0.	-1.00000	6.3400	-2.1740	-0.8640
978	13	34	0.0100000	0.	0.	-1.00000	6.3400	-2.0740	-0.8640
979	14	34	0.0100000	0.	0.	-1.00000	6.3400	-1.9740	-0.8640
980	15	34	0.0100000	0.	0.	-1.00000	6.3400	-1.8740	-0.8640
981	16	34	0.0100000	0.	0.	-1.00000	6.3400	-1.7740	-0.8640
982	17	34	0.0100000	0.	0.	-1.00000	6.3400	-1.6740	-0.8640
983	18	34	0.0100000	0.	0.	-1.00000	6.3400	-1.5740	-0.8640
984	19	34	0.0100000	0.	0.	-1.00000	6.3400	-1.4740	-0.8640
985	20	34	0.0100000	0.	0.	-1.00000	6.3400	-1.3740	-0.8640
986	21	34	0.0100000	0.	0.	-1.00000	6.3400	-1.2740	-0.8640
987	22	34	0.0100000	0.	0.	-1.00000	6.3400	-1.1740	-0.8640



TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1035	70	34	0.0100000	0.	0.	-1.00000	5.9400	-1.5740	-0.8640
1036	71	34	0.0100000	0.	0.	-1.00000	5.9400	-1.4740	-0.8640
1037	72	34	0.0100000	0.	0.	-1.00000	5.9400	-1.3740	-0.8640
1038	73	34	0.0100000	0.	0.	-1.00000	5.9400	-1.2740	-0.8640
1039	74	34	0.0100000	0.	0.	-1.00000	5.9400	-1.1740	-0.8640
1040	75	34	0.0100000	0.	0.	-1.00000	5.9400	-1.0740	-0.8640
1041	76	34	0.0089000	0.	0.	-1.00000	5.9400	-0.9800	-0.8640
1042	77	34	0.0100000	0.	0.	-1.00000	5.8400	-2.1740	-0.8640
1043	78	34	0.0100000	0.	0.	-1.00000	5.8400	-2.0740	-0.8640
1044	79	34	0.0100000	0.	0.	-1.00000	5.8400	-1.9740	-0.8640
1045	80	34	0.0100000	0.	0.	-1.00000	5.8400	-1.8740	-0.8640
1046	81	34	0.0100000	0.	0.	-1.00000	5.8400	-1.7740	-0.8640
1047	82	34	0.0100000	0.	0.	-1.00000	5.8400	-1.6740	-0.8640
1048	83	34	0.0100000	0.	0.	-1.00000	5.8400	-1.5740	-0.8640
1049	84	34	0.0100000	0.	0.	-1.00000	5.8400	-1.4740	-0.8640
1050	85	34	0.0100000	0.	0.	-1.00000	5.8400	-1.3740	-0.8640
1051	86	34	0.0100000	0.	0.	-1.00000	5.8400	-1.2740	-0.8640
1052	87	34	0.0100000	0.	0.	-1.00000	5.8400	-1.1740	-0.8640
1053	88	34	0.0100000	0.	0.	-1.00000	5.8400	-1.0740	-0.8640
1054	89	34	0.0089000	0.	0.	-1.00000	5.8400	-0.9800	-0.8640
1055	90	34	0.0100000	0.	0.	-1.00000	5.7400	-2.1740	-0.8640
1056	91	34	0.0100000	0.	0.	-1.00000	5.7400	-2.0740	-0.8640
1057	92	34	0.0100000	0.	0.	-1.00000	5.7400	-1.9740	-0.8640
1058	93	34	0.0100000	0.	0.	-1.00000	5.7400	-1.8740	-0.8640
1059	94	34	0.0100000	0.	0.	-1.00000	5.7400	-1.7740	-0.8640
1060	95	34	0.0100000	0.	0.	-1.00000	5.7400	-1.6740	-0.8640
1061	96	34	0.0100000	0.	0.	-1.00000	5.7400	-1.5740	-0.8640
1062	97	34	0.0100000	0.	0.	-1.00000	5.7400	-1.4740	-0.8640
1063	98	34	0.0100000	0.	0.	-1.00000	5.7400	-1.3740	-0.8640
1064	99	34	0.0100000	0.	0.	-1.00000	5.7400	-1.2740	-0.8640
1065	100	34	0.0100000	0.	0.	-1.00000	5.7400	-1.1740	-0.8640
1066	101	34	0.0100000	0.	0.	-1.00000	5.7400	-1.0740	-0.8640
1067	102	34	0.0100000	0.	0.	-1.00000	5.7400	-0.9740	-0.8640
1068	103	34	0.0035000	0.	0.	-1.00000	5.7400	-0.9070	-0.8640
1069	104	34	0.0100000	0.	0.	-1.00000	5.6400	-2.1740	-0.8640
1070	105	34	0.0100000	0.	0.	-1.00000	5.6400	-2.0740	-0.8640
1071	106	34	0.0100000	0.	0.	-1.00000	5.6400	-1.9740	-0.8640
1072	107	34	0.0100000	0.	0.	-1.00000	5.6400	-1.8740	-0.8640
1073	108	34	0.0100000	0.	0.	-1.00000	5.6400	-1.7740	-0.8640
1074	109	34	0.0100000	0.	0.	-1.00000	5.6400	-1.6740	-0.8640
1075	110	34	0.0100000	0.	0.	-1.00000	5.6400	-1.5740	-0.8640
1076	111	34	0.0100000	0.	0.	-1.00000	5.6400	-1.4740	-0.8640
1077	112	34	0.0100000	0.	0.	-1.00000	5.6400	-1.3740	-0.8640
1078	113	34	0.0100000	0.	0.	-1.00000	5.6400	-1.2740	-0.8640
1079	114	34	0.0100000	0.	0.	-1.00000	5.6400	-1.1740	-0.8640
1080	115	34	0.0100000	0.	0.	-1.00000	5.6400	-1.0740	-0.8640
1081	116	34	0.0100000	0.	0.	-1.00000	5.6400	-0.9740	-0.8640

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM			
				I	J	K	X	Y	Z	
1082	117	34	0.0125000	0.	0.	-1.00000	5.6400	-0.8615	-0.8640	
1083	118	34	0.0100000	0.	0.	-1.00000	5.5400	-2.1740	-0.8640	
1084	119	34	0.0100000	0.	0.	-1.00000	5.5400	-2.0740	-0.8640	
1085	120	34	0.0100000	0.	0.	-1.00000	5.5400	-1.9740	-0.8640	
1086	121	34	0.0100000	0.	0.	-1.00000	5.5400	-1.8740	-0.8640	
1087	122	34	0.0100000	0.	0.	-1.00000	5.5400	-1.7740	-0.8640	
1088	123	34	0.0100000	0.	0.	-1.00000	5.5400	-1.6740	-0.8640	
1089	124	34	0.0100000	0.	0.	-1.00000	5.5400	-1.5740	-0.8640	
1090	125	34	0.0100000	0.	0.	-1.00000	5.5400	-1.4740	-0.8640	
1091	126	34	0.0100000	0.	0.	-1.00000	5.5400	-1.3740	-0.8640	
1092	127	34	0.0100000	0.	0.	-1.00000	5.5400	-1.2740	-0.8640	
1093	128	34	0.0100000	0.	0.	-1.00000	5.5400	-1.1740	-0.8640	
1094	129	34	0.0100000	0.	0.	-1.00000	5.5400	-1.0740	-0.8640	
1095	130	34	0.0100000	0.	0.	-1.00000	5.5400	-0.9740	-0.8640	
1096	131	34	0.0100000	0.	0.	-1.00000	5.5400	-0.8740	-0.8640	
1097	132	34	0.0114000	0.	0.	-1.00000	5.5400	-0.7610	-0.8640	
1098	133	34	0.0100000	0.	0.	-1.00000	5.4400	-2.1740	-0.8640	
1099	134	34	0.0100000	0.	0.	-1.00000	5.4400	-2.0740	-0.8640	
1100	135	34	0.0100000	0.	0.	-1.00000	5.4400	-1.9740	-0.8640	
1101	136	34	0.0100000	0.	0.	-1.00000	5.4400	-1.8740	-0.8640	
1102	137	34	0.0100000	0.	0.	-1.00000	5.4400	-1.7740	-0.8640	
1103	138	34	0.0100000	0.	0.	-1.00000	5.4400	-1.6740	-0.8640	
1104	139	34	0.0100000	0.	0.	-1.00000	5.4400	-1.5740	-0.8640	
1105	140	34	0.0100000	0.	0.	-1.00000	5.4400	-1.4740	-0.8640	
1106	141	34	0.0100000	0.	0.	-1.00000	5.4400	-1.3740	-0.8640	
1107	142	34	0.0100000	0.	0.	-1.00000	5.4400	-1.2740	-0.8640	
1108	143	34	0.0100000	0.	0.	-1.00000	5.4400	-1.1740	-0.8640	
1109	144	34	0.0100000	0.	0.	-1.00000	5.4400	-1.0740	-0.8640	
1110	145	34	0.0100000	0.	0.	-1.00000	5.4400	-0.9740	-0.8640	
1111	146	34	0.0100000	0.	0.	-1.00000	5.4400	-0.8740	-0.8640	
1112	147	34	0.0100000	0.	0.	-1.00000	5.4400	-0.7740	-0.8640	
1113	148	34	0.0104000	0.	0.	-1.00000	5.4400	-0.6720	-0.8640	
1114	149	34	0.0100000	0.	0.	-1.00000	5.3400	-2.1740	-0.8640	
1115	150	34	0.0100000	0.	0.	-1.00000	5.3400	-2.0740	-0.8640	
1116	151	34	0.0100000	0.	0.	-1.00000	5.3400	-1.9740	-0.8640	
1117	152	34	0.0100000	0.	0.	-1.00000	5.3400	-1.8740	-0.8640	
1118	153	34	0.0100000	0.	0.	-1.00000	5.3400	-1.7740	-0.8640	
1119	154	34	0.0100000	0.	0.	-1.00000	5.3400	-1.6740	-0.8640	
1120	155	34	0.0100000	0.	0.	-1.00000	5.3400	-1.5740	-0.8640	
1121	156	34	0.0100000	0.	0.	-1.00000	5.3400	-1.4740	-0.8640	
1122	157	34	0.0100000	0.	0.	-1.00000	5.3400	-1.3740	-0.8640	
1123	158	34	0.0100000	0.	0.	-1.00000	5.3400	-1.2740	-0.8640	
1124	159	34	0.0100000	0.	0.	-1.00000	5.3400	-1.1740	-0.8640	
1125	160	34	0.0100000	0.	0.	-1.00000	5.3400	-1.0740	-0.8640	
1126	161	34	0.0121000	0.	0.	-1.00000	5.3400	-0.9640	-0.8640	
1127	162	34	0.0100000	0.	0.	-1.00000	5.2400	-2.1740	-0.8640	
1128	163	34	0.0100000	0.	0.	-1.00000	5.2400	-2.0740	-0.8640	

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1129	164	34	0.0100000	0.	0.	-1.00000	5.2400	-1.9740	-0.8640
1130	165	34	0.0100000	0.	0.	-1.00000	5.2400	-1.8740	-0.8640
1131	166	34	0.0100000	0.	0.	-1.00000	5.2400	-1.7740	-0.8640
1132	167	34	0.0100000	0.	0.	-1.00000	5.2400	-1.6740	-0.8640
1133	168	34	0.0100000	0.	0.	-1.00000	5.2400	-1.5740	-0.8640
1134	169	34	0.0100000	0.	0.	-1.00000	5.2400	-1.4740	-0.8640
1135	170	34	0.0100000	0.	0.	-1.00000	5.2400	-1.3740	-0.8640
1136	171	34	0.0078000	0.	0.	-1.00000	5.2400	-1.2850	-0.8640
1137	172	34	0.0099000	0.	0.	-1.00000	5.1410	-2.0160	-0.8640
1138	173	34	0.0100000	0.	0.	-1.00000	5.1400	-1.9160	-0.8640
1139	174	34	0.0100000	0.	0.	-1.00000	5.1400	-1.8160	-0.8640
1140	175	34	0.0100000	0.	0.	-1.00000	5.1400	-1.7160	-0.8640
1141	176	34	0.0079200	0.	0.	-1.00000	5.1400	-1.6260	-0.8640
1142	1	35	2.5780000	0.	0.	-1.00000			
1143	1	36	0.0100000	0.	0.	-1.00000	7.8880	0.5450	-0.8640
1144	2	36	0.0100000	0.	0.	-1.00000	7.8800	0.6450	-0.8640
1145	3	36	0.0100000	0.	0.	-1.00000	7.8800	0.7450	-0.8640
1146	4	36	0.0100000	0.	0.	-1.00000	7.8800	0.8450	-0.8640
1147	5	36	0.0100000	0.	0.	-1.00000	7.8800	0.9450	-0.8640
1148	6	36	0.0100000	0.	0.	-1.00000	7.8800	1.0450	-0.8640
1149	7	36	0.0094000	0.	0.	-1.00000	7.8800	1.1420	-0.8640
1150	8	36	0.0100000	0.	0.	-1.00000	7.8800	0.5450	-0.8640
1151	9	36	0.0100000	0.	0.	-1.00000	7.8800	0.6450	-0.8640
1152	10	36	0.0100000	0.	0.	-1.00000	7.8800	0.7450	-0.8640
1153	11	36	0.0100000	0.	0.	-1.00000	7.8800	0.8450	-0.8640
1154	12	36	0.0100000	0.	0.	-1.00000	7.8800	0.9450	-0.8640
1155	13	36	0.0100000	0.	0.	-1.00000	7.7880	1.0450	-0.8640
1156	14	36	0.0100000	0.	0.	-1.00000	7.7800	1.1450	-0.8640
1157	15	36	0.0098000	0.	0.	-1.00000	7.7800	1.2440	-0.8640
1158	16	36	0.0100000	0.	0.	-1.00000	7.6880	0.5450	-0.8640
1159	17	36	0.0100000	0.	0.	-1.00000	7.6800	0.6450	-0.8640
1160	18	36	0.0100000	0.	0.	-1.00000	7.6800	0.7450	-0.8640
1161	19	36	0.0100000	0.	0.	-1.00000	7.6800	0.8450	-0.8640
1162	20	36	0.0100000	0.	0.	-1.00000	7.6800	0.9450	-0.8640
1163	21	36	0.0100000	0.	0.	-1.00000	7.6800	1.0450	-0.8640
1164	22	36	0.0100000	0.	0.	-1.00000	7.6800	1.1450	-0.8640
1165	23	36	0.0100000	0.	0.	-1.00000	7.6800	1.2450	-0.8640
1166	24	36	0.0050000	0.	0.	-1.00000	7.6800	1.3200	-0.8640
1167	25	36	0.0100000	0.	0.	-1.00000	7.5880	0.5450	-0.8640
1168	26	36	0.0100000	0.	0.	-1.00000	7.5800	0.6450	-0.8640
1169	27	36	0.0100000	0.	0.	-1.00000	7.5800	0.7450	-0.8640
1170	28	36	0.0100000	0.	0.	-1.00000	7.5800	0.8450	-0.8640
1171	29	36	0.0100000	0.	0.	-1.00000	7.5800	0.9450	-0.8640
1172	30	36	0.0100000	0.	0.	-1.00000	7.5800	1.0450	-0.8640
1173	31	36	0.0100000	0.	0.	-1.00000	7.5800	1.1450	-0.8640
1174	32	36	0.0100000	0.	0.	-1.00000	7.5800	1.2450	-0.8640
1175	33	36	0.0073000	0.	0.	-1.00000	7.5800	1.3320	-0.8640

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1176	34	36	0.0100000	0.	0.	-1.00000	7.4880	0.5785	-0.8640
1177	35	36	0.0100000	0.	0.	-1.00000	7.4800	0.6785	-0.8640
1178	36	36	0.0100000	0.	0.	-1.00000	7.4800	0.7785	-0.8640
1179	37	36	0.0100000	0.	0.	-1.00000	7.4800	0.8785	-0.8640
1180	38	36	0.0100000	0.	0.	-1.00000	7.4800	0.9785	-0.8640
1181	39	36	0.0100000	0.	0.	-1.00000	7.4800	1.0785	-0.8640
1182	40	36	0.0100000	0.	0.	-1.00000	7.4800	1.1785	-0.8640
1183	41	36	0.0100000	0.	0.	-1.00000	7.4800	1.2785	-0.8640
1184	42	36	0.0043500	0.	0.	-1.00000	7.4800	1.3502	-0.8640
1185	43	36	0.0100000	0.	0.	-1.00000	7.3880	0.6868	-0.8640
1186	44	36	0.0100000	0.	0.	-1.00000	7.3800	0.7868	-0.8640
1187	45	36	0.0100000	0.	0.	-1.00000	7.3800	0.8868	-0.8640
1188	46	36	0.0100000	0.	0.	-1.00000	7.3800	0.9868	-0.8640
1189	47	36	0.0100000	0.	0.	-1.00000	7.3800	1.0868	-0.8640
1190	48	36	0.0100000	0.	0.	-1.00000	7.3800	1.1868	-0.8640
1191	49	36	0.0100000	0.	0.	-1.00000	7.3800	1.2868	-0.8640
1192	50	36	0.0035200	0.	0.	-1.00000	7.3800	1.3544	-0.8640
1193	51	36	0.0100000	0.	0.	-1.00000	7.2880	0.7950	-0.8640
1194	52	36	0.0100000	0.	0.	-1.00000	7.2800	0.8950	-0.8640
1195	53	36	0.0100000	0.	0.	-1.00000	7.2800	0.9950	-0.8640
1196	54	36	0.0100000	0.	0.	-1.00000	7.2800	1.0950	-0.8640
1197	55	36	0.0100000	0.	0.	-1.00000	7.2800	1.1950	-0.8640
1198	56	36	0.0127000	0.	0.	-1.00000	7.2800	1.3085	-0.8640
1199	57	36	0.0100000	0.	0.	-1.00000	7.1880	0.9032	-0.8640
1200	58	36	0.0100000	0.	0.	-1.00000	7.1880	1.0032	-0.8640
1201	59	36	0.0100000	0.	0.	-1.00000	7.1800	1.1032	-0.8640
1202	60	36	0.0100000	0.	0.	-1.00000	7.1800	1.2032	-0.8640
1203	61	36	0.0118800	0.	0.	-1.00000	7.1800	1.3126	-0.8640
1204	62	36	0.0100000	0.	0.	-1.00000	7.0880	1.0080	-0.8640
1205	63	36	0.0100000	0.	0.	-1.00000	7.0880	1.1080	-0.8640
1206	64	36	0.0100000	0.	0.	-1.00000	7.0880	1.2080	-0.8640
1207	65	36	0.0114000	0.	0.	-1.00000	7.0880	1.3170	-0.8640
1208	66	36	0.0100000	0.	0.	-1.00000	6.9880	1.0470	-0.8640
1209	67	36	0.0100000	0.	0.	-1.00000	6.9880	1.1470	-0.8640
1210	68	36	0.0100000	0.	0.	-1.00000	6.9880	1.2470	-0.8640
1211	69	36	0.0075000	0.	0.	-1.00000	6.9880	1.3345	-0.8640
1212	70	36	0.0100000	0.	0.	-1.00000	6.8880	1.0860	-0.8640
1213	71	36	0.0100000	0.	0.	-1.00000	6.8880	1.1860	-0.8640
1214	72	36	0.0136000	0.	0.	-1.00000	6.8880	1.3040	-0.8640
1215	73	36	0.0100000	0.	0.	-1.00000	6.7880	1.1250	-0.8640
1216	74	36	0.0100000	0.	0.	-1.00000	6.7880	1.2250	-0.8640
1217	75	36	0.0097000	0.	0.	-1.00000	6.7880	1.3235	-0.8640
1218	76	36	0.0100000	0.	0.	-1.00000	6.6880	1.1640	-0.8640
1219	77	36	0.0100000	0.	0.	-1.00000	6.6880	1.2640	-0.8640
1220	78	36	0.0058000	0.	0.	-1.00000	6.6880	1.3430	-0.8640
1221	79	36	0.0100000	0.	0.	-1.00000	6.5880	1.2030	-0.8640
1222	80	36	0.0119000	0.	0.	-1.00000	6.5880	1.3120	-0.8640

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1223	81	36	0.0086000	0.	0.	-1.00000	6.4950	1.2390	-0.8640
1224	82	36	0.0071380	0.	0.	-1.00000	6.4950	1.3300	-0.8640
1225	1	37	0.0100000	0.	0.	-1.00000	6.4016	1.2373	-0.8640
1226	2	37	0.0100000	0.	0.	-1.00000	6.4016	1.3373	-0.8640
1227	3	37	0.0084100	0.	0.	-1.00000	6.4016	1.4294	-0.8640
1228	4	37	0.0100000	0.	0.	-1.00000	6.3016	1.2003	-0.8640
1229	5	37	0.0100000	0.	0.	-1.00000	6.3016	1.3003	-0.8640
1230	6	37	0.0100000	0.	0.	-1.00000	6.3016	1.4003	-0.8640
1231	7	37	0.0058400	0.	0.	-1.00000	6.3016	1.4795	-0.8640
1232	8	37	0.0100000	0.	0.	-1.00000	6.2016	1.1633	-0.8640
1233	9	37	0.0100000	0.	0.	-1.00000	6.2016	1.2633	-0.8640
1234	10	37	0.0100000	0.	0.	-1.00000	6.2016	1.3633	-0.8640
1235	11	37	0.0100000	0.	0.	-1.00000	6.2016	1.4633	-0.8640
1236	12	37	0.0100000	0.	0.	-1.00000	6.2016	1.5633	-0.8640
1237	13	37	0.0083700	0.	0.	-1.00000	6.2016	1.6552	-0.8640
1238	14	37	0.0100000	0.	0.	-1.00000	6.1016	1.1263	-0.8640
1239	15	37	0.0100000	0.	0.	-1.00000	6.1016	1.2263	-0.8640
1240	16	37	0.0100000	0.	0.	-1.00000	6.1016	1.3263	-0.8640
1241	17	37	0.0100000	0.	0.	-1.00000	6.1016	1.4263	-0.8640
1242	18	37	0.0100000	0.	0.	-1.00000	6.1016	1.5263	-0.8640
1243	19	37	0.0100000	0.	0.	-1.00000	6.1016	1.6263	-0.8640
1244	20	37	0.0083400	0.	0.	-1.00000	6.1016	1.7180	-0.8640
1245	21	37	0.0100000	0.	0.	-1.00000	6.0016	1.0893	-0.8640
1246	22	37	0.0100000	0.	0.	-1.00000	6.0016	1.1893	-0.8640
1247	23	37	0.0100000	0.	0.	-1.00000	6.0016	1.2893	-0.8640
1248	24	37	0.0100000	0.	0.	-1.00000	6.0016	1.3893	-0.8640
1249	25	37	0.0100000	0.	0.	-1.00000	6.0016	1.4893	-0.8640
1250	26	37	0.0100000	0.	0.	-1.00000	6.0016	1.5893	-0.8640
1251	27	37	0.0100000	0.	0.	-1.00000	6.0016	1.6893	-0.8640
1252	28	37	0.0058500	0.	0.	-1.00000	6.0016	1.7686	-0.8640
1253	29	37	0.0100000	0.	0.	-1.00000	5.9016	1.0523	-0.8640
1254	30	37	0.0100000	0.	0.	-1.00000	5.9016	1.1523	-0.8640
1255	31	37	0.0100000	0.	0.	-1.00000	5.9016	1.2523	-0.8640
1256	32	37	0.0100000	0.	0.	-1.00000	5.9016	1.3523	-0.8640
1257	33	37	0.0100000	0.	0.	-1.00000	5.9016	1.4523	-0.8640
1258	34	37	0.0100000	0.	0.	-1.00000	5.9016	1.5523	-0.8640
1259	35	37	0.0100000	0.	0.	-1.00000	5.9016	1.6523	-0.8640
1260	36	37	0.0118200	0.	0.	-1.00000	5.9016	1.7614	-0.8640
1261	37	37	0.0100000	0.	0.	-1.00000	5.8016	1.0153	-0.8640
1262	38	37	0.0100000	0.	0.	-1.00000	5.8016	1.1153	-0.8640
1263	39	37	0.0100000	0.	0.	-1.00000	5.8016	1.2153	-0.8640
1264	40	37	0.0100000	0.	0.	-1.00000	5.8016	1.3153	-0.8640
1265	41	37	0.0100000	0.	0.	-1.00000	5.8016	1.4153	-0.8640
1266	42	37	0.0100000	0.	0.	-1.00000	5.8016	1.5153	-0.8640
1267	43	37	0.0100000	0.	0.	-1.00000	5.8016	1.6153	-0.8640
1268	44	37	0.0100000	0.	0.	-1.00000	5.8016	1.7153	-0.8640
1269	45	37	0.0064900	0.	0.	-1.00000	5.8016	1.7978	-0.8640

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1270	46	37	0.0100000	0.	0.	-1.00000	5.7016	0.9412	-0.8640
1271	47	37	0.0100000	0.	0.	-1.00000	5.7016	1.0412	-0.8640
1272	48	37	0.0100000	0.	0.	-1.00000	5.7016	1.1412	-0.8640
1273	49	37	0.0100000	0.	0.	-1.00000	5.7016	1.2412	-0.8640
1274	50	37	0.0100000	0.	0.	-1.00000	5.7016	1.3412	-0.8640
1275	51	37	0.0100000	0.	0.	-1.00000	5.7016	1.4412	-0.8640
1276	52	37	0.0100000	0.	0.	-1.00000	5.7016	1.5412	-0.8640
1277	53	37	0.0100000	0.	0.	-1.00000	5.7016	1.6412	-0.8640
1278	54	37	0.0133300	0.	0.	-1.00000	5.7016	1.7578	-0.8640
1279	55	37	0.0100000	0.	0.	-1.00000	5.6016	0.8172	-0.8640
1280	56	37	0.0100000	0.	0.	-1.00000	5.6016	0.9172	-0.8640
1281	57	37	0.0100000	0.	0.	-1.00000	5.6016	1.0127	-0.8640
1282	58	37	0.0100000	0.	0.	-1.00000	5.6016	1.1127	-0.8640
1283	59	37	0.0100000	0.	0.	-1.00000	5.6016	1.2127	-0.8640
1284	60	37	0.0100000	0.	0.	-1.00000	5.6016	1.3127	-0.8640
1285	61	37	0.0100000	0.	0.	-1.00000	5.6016	1.4127	-0.8640
1286	62	37	0.0100000	0.	0.	-1.00000	5.6016	1.5127	-0.8640
1287	63	37	0.0100000	0.	0.	-1.00000	5.6016	1.6127	-0.8640
1288	64	37	0.0136900	0.	0.	-1.00000	5.6016	1.7356	-0.8640
1289	65	37	0.0100000	0.	0.	-1.00000	5.5016	0.6931	-0.8640
1290	66	37	0.0100000	0.	0.	-1.00000	5.5016	0.7931	-0.8640
1291	67	37	0.0100000	0.	0.	-1.00000	5.5016	0.8931	-0.8640
1292	68	37	0.0100000	0.	0.	-1.00000	5.5016	0.9931	-0.8640
1293	69	37	0.0100000	0.	0.	-1.00000	5.5016	1.0931	-0.8640
1294	70	37	0.0100000	0.	0.	-1.00000	5.5016	1.1931	-0.8640
1295	71	37	0.0100000	0.	0.	-1.00000	5.5016	1.2931	-0.8640
1296	72	37	0.0100000	0.	0.	-1.00000	5.5016	1.3931	-0.8640
1297	73	37	0.0100000	0.	0.	-1.00000	5.5016	1.4931	-0.8640
1298	74	37	0.0100000	0.	0.	-1.00000	5.5016	1.5931	-0.8640
1299	75	37	0.0100000	0.	0.	-1.00000	5.5016	1.6931	-0.8640
1300	76	37	0.0086700	0.	0.	-1.00000	5.5016	1.7864	-0.8640
1301	77	37	0.0100000	0.	0.	-1.00000	5.4016	0.6021	-0.8640
1302	78	37	0.0100000	0.	0.	-1.00000	5.4016	0.7021	-0.8640
1303	79	37	0.0100000	0.	0.	-1.00000	5.4016	0.8021	-0.8640
1304	80	37	0.0100000	0.	0.	-1.00000	5.4016	0.9021	-0.8640
1305	81	37	0.0100000	0.	0.	-1.00000	5.4016	1.0021	-0.8640
1306	82	37	0.0100000	0.	0.	-1.00000	5.4016	1.1021	-0.8640
1307	83	37	0.0100000	0.	0.	-1.00000	5.4016	1.2021	-0.8640
1308	84	37	0.0100000	0.	0.	-1.00000	5.4016	1.3021	-0.8640
1309	85	37	0.0100000	0.	0.	-1.00000	5.4016	1.4021	-0.8640
1310	86	37	0.0100000	0.	0.	-1.00000	5.4016	1.5021	-0.8640
1311	87	37	0.0100000	0.	0.	-1.00000	5.4016	1.6021	-0.8640
1312	88	37	0.0100000	0.	0.	-1.00000	5.4016	1.7021	-0.8640
1313	89	37	0.0077700	0.	0.	-1.00000	5.4016	1.7910	-0.8640
1314	90	37	0.0100000	0.	0.	-1.00000	5.3016	0.6836	-0.8640
1315	91	37	0.0100000	0.	0.	-1.00000	5.3016	0.7836	-0.8640
1316	92	37	0.0100000	0.	0.	-1.00000	5.3016	0.8836	-0.8640

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM			
				I	J	K	X	Y	Z	
1317	93	37	0.0100000	0.	0.	-1.00000	5.3016	0.9836	-0.8640	
1318	94	37	0.0100000	0.	0.	-1.00000	5.3016	1.0836	-0.8640	
1319	95	37	0.0100000	0.	0.	-1.00000	5.3016	1.1836	-0.8640	
1320	96	37	0.0100000	0.	0.	-1.00000	5.3016	1.2836	-0.8640	
1321	97	37	0.0100000	0.	0.	-1.00000	5.3016	1.3836	-0.8640	
1322	98	37	0.0100000	0.	0.	-1.00000	5.3016	1.4836	-0.8640	
1323	99	37	0.0100000	0.	0.	-1.00000	5.3016	1.5836	-0.8640	
1324	100	37	0.0100000	0.	0.	-1.00000	5.3016	1.6836	-0.8640	
1325	101	37	0.0096200	0.	0.	-1.00000	5.3016	1.7817	-0.8640	
1326	102	37	0.0100000	0.	0.	-1.00000	5.2016	0.8072	-0.8640	
1327	103	37	0.0100000	0.	0.	-1.00000	5.2016	0.9072	-0.8640	
1328	104	37	0.0100000	0.	0.	-1.00000	5.2016	1.0072	-0.8640	
1329	105	37	0.0100000	0.	0.	-1.00000	5.2016	1.1072	-0.8640	
1330	106	37	0.0100000	0.	0.	-1.00000	5.2016	1.2072	-0.8640	
1331	107	37	0.0100000	0.	0.	-1.00000	5.2016	1.3072	-0.8640	
1332	108	37	0.0100000	0.	0.	-1.00000	5.2016	1.4072	-0.8640	
1333	109	37	0.0100000	0.	0.	-1.00000	5.2016	1.5072	-0.8640	
1334	110	37	0.0100000	0.	0.	-1.00000	5.2016	1.6072	-0.8640	
1335	111	37	0.0100000	0.	0.	-1.00000	5.2016	1.7072	-0.8640	
1336	112	37	0.0072100	0.	0.	-1.00000	5.2016	1.7932	-0.8640	
1337	113	37	0.0024100	0.	0.	-1.00000	5.1395	0.9302	-0.8640	
1338	114	37	0.0024100	0.	0.	-1.00000	5.1395	1.0302	-0.8640	
1339	115	37	0.0024100	0.	0.	-1.00000	5.1395	1.1302	-0.8640	
1340	116	37	0.0024100	0.	0.	-1.00000	5.1395	1.2302	-0.8640	
1341	117	37	0.0024100	0.	0.	-1.00000	5.1395	1.3302	-0.8640	
1342	118	37	0.0024100	0.	0.	-1.00000	5.1395	1.4302	-0.8640	
1343	119	37	0.0024100	0.	0.	-1.00000	5.1395	1.5302	-0.8640	
1344	120	37	0.0024100	0.	0.	-1.00000	5.1395	1.6302	-0.8640	
1345	121	37	0.0024100	0.	0.	-1.00000	5.1395	1.7302	-0.8640	
1346	122	37	0.0011950	0.	0.	-1.00000	5.1395	1.8050	-0.8640	
1347	1	38	0.0067100	0.	0.	-1.00000	5.3320	-0.4907	-0.8640	
1348	2	38	0.0067100	0.	0.	-1.00000	5.3320	-0.3907	-0.8640	
1349	3	38	0.0067100	0.	0.	-1.00000	5.3320	-0.2907	-0.8640	
1350	4	38	0.0067100	0.	0.	-1.00000	5.3320	-0.1907	-0.8640	
1351	5	38	0.0067100	0.	0.	-1.00000	5.3320	-0.0907	-0.8640	
1352	6	38	0.0067100	0.	0.	-1.00000	5.3320	0.0093	-0.8640	
1353	7	38	0.0067100	0.	0.	-1.00000	5.3320	0.1093	-0.8640	
1354	8	38	0.0067100	0.	0.	-1.00000	5.3320	0.2093	-0.8640	
1355	9	38	0.0067100	0.	0.	-1.00000	5.3320	0.3093	-0.8640	
1356	10	38	0.0067100	0.	0.	-1.00000	5.3320	0.4093	-0.8640	
1357	11	38	0.0054600	0.	0.	-1.00000	5.3320	0.5000	-0.8640	
1358	1	39	0.0056000	0.	-0.98306	-0.18329	7.0520	-0.9810	-1.6920	
1359	2	39	0.0100000	0.	-0.98306	-0.18329	6.9520	-0.9810	-1.6920	
1360	3	39	0.0100000	0.	-0.98306	-0.18329	6.8520	-0.9810	-1.6920	
1361	4	39	0.0100000	0.	-0.98306	-0.18329	6.7520	-0.9810	-1.6920	
1362	5	39	0.0100000	0.	-0.98306	-0.18329	6.6520	-0.9810	-1.6920	
1363	6	39	0.0100000	0.	-0.98306	-0.18329	6.5520	-0.9810	-1.6920	

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1364	7	39	0.0100000	0.	-0.98306	-0.18329	6.4520	-0.9810	-1.6920
1365	8	39	0.0100000	0.	-0.98306	-0.18329	6.3520	-0.9810	-1.6920
1366	9	39	0.0100000	0.	-0.98306	-0.18329	6.2520	-0.9810	-1.6920
1367	10	39	0.0100000	0.	-0.98306	-0.18329	6.1520	-0.9810	-1.6920
1368	11	39	0.0100000	0.	-0.98306	-0.18329	6.0520	-0.9810	-1.6920
1369	12	39	0.0100000	0.	-0.98306	-0.18329	5.9850	-0.9810	-1.6920
1370	13	39	0.0056000	0.	-0.98306	-0.18329	5.8520	-0.9810	-1.6920
1371	14	39	0.0081000	0.	-0.98306	-0.18329	6.9520	-0.9990	-1.5940
1372	15	39	0.0100000	0.	-0.98306	-0.18329	6.8520	-0.9990	-1.5940
1373	16	39	0.0100000	0.	-0.98306	-0.18329	6.7520	-0.9990	-1.5940
1374	17	39	0.0100000	0.	-0.98306	-0.18329	6.6520	-0.9990	-1.5940
1375	18	39	0.0100000	0.	-0.98306	-0.18329	6.5520	-0.9990	-1.5940
1376	19	39	0.0100000	0.	-0.98306	-0.18329	6.4520	-0.9990	-1.5940
1377	20	39	0.0100000	0.	-0.98306	-0.18329	6.3520	-0.9990	-1.5940
1378	21	39	0.0100000	0.	-0.98306	-0.18329	6.2520	-0.9990	-1.5940
1379	22	39	0.0100000	0.	-0.98306	-0.18329	6.1520	-0.9990	-1.5940
1380	23	39	0.0100000	0.	-0.98306	-0.18329	6.0520	-0.9990	-1.5940
1381	24	39	0.0081000	0.	-0.98306	-0.18329	5.9520	-0.9990	-1.5940
1382	25	39	0.0105000	0.	-0.98306	-0.18329	6.8520	-1.0170	-1.4960
1383	26	39	0.0100000	0.	-0.98306	-0.18329	6.7520	-1.0170	-1.4960
1384	27	39	0.0100000	0.	-0.98306	-0.18329	6.6520	-1.0170	-1.4960
1385	28	39	0.0100000	0.	-0.98306	-0.18329	6.5520	-1.0170	-1.4960
1386	29	39	0.0100000	0.	-0.98306	-0.18329	6.4520	-1.0170	-1.4960
1387	30	39	0.0100000	0.	-0.98306	-0.18329	6.3520	-1.0170	-1.4960
1388	31	39	0.0100000	0.	-0.98306	-0.18329	6.2520	-1.0170	-1.4960
1389	32	39	0.0100000	0.	-0.98306	-0.18329	6.1520	-1.0170	-1.4960
1390	33	39	0.0105000	0.	-0.98306	-0.18329	6.0520	-1.0170	-1.4960
1391	34	39	0.0129000	0.	-0.98306	-0.18329	6.7520	-1.0350	-1.3980
1392	35	39	0.0100000	0.	-0.98306	-0.18329	6.6520	-1.0350	-1.3980
1393	36	39	0.0100000	0.	-0.98306	-0.18329	6.5520	-1.0350	-1.3980
1394	37	39	0.0100000	0.	-0.98306	-0.18329	6.4520	-1.0350	-1.3980
1395	38	39	0.0100000	0.	-0.98306	-0.18329	6.3520	-1.0350	-1.3980
1396	39	39	0.0100000	0.	-0.98306	-0.18329	6.2520	-1.0350	-1.3980
1397	40	39	0.0129000	0.	-0.98306	-0.18329	6.1520	-1.0350	-1.3980
1398	41	39	0.0053000	0.	-0.98306	-0.18329	6.7520	-1.0540	-1.3000
1399	42	39	0.0100000	0.	-0.98306	-0.18329	6.6520	-1.0540	-1.3000
1400	43	39	0.0100000	0.	-0.98306	-0.18329	6.5520	-1.0540	-1.3000
1401	44	39	0.0100000	0.	-0.98306	-0.18329	6.4520	-1.0540	-1.3000
1402	45	39	0.0100000	0.	-0.98306	-0.18329	6.3520	-1.0540	-1.3000
1403	46	39	0.0100000	0.	-0.98306	-0.18329	6.2520	-1.0540	-1.3000
1404	47	39	0.0073000	0.	-0.98306	-0.18329	6.1520	-1.0540	-1.3000
1405	48	39	0.0077000	0.	-0.98306	-0.18329	6.6520	-1.0720	-1.2020
1406	49	39	0.0100000	0.	-0.98306	-0.18329	6.5520	-1.0720	-1.2020
1407	50	39	0.0100000	0.	-0.98306	-0.18329	6.4520	-1.0720	-1.2020
1408	51	39	0.0100000	0.	-0.98306	-0.18329	6.3520	-1.0720	-1.2020
1409	52	39	0.0077000	0.	-0.98306	-0.18329	6.2520	-1.0720	-1.2020
1410	53	39	0.0102000	0.	-0.98306	-0.18329	6.5520	-1.0900	-1.1040



TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1411	54	39	0.0100000	0.	-0.98306	-0.18329	6.4520	-1.0900	-1.1040
1412	55	39	0.0102000	0.	-0.98306	-0.18329	6.3520	-1.0900	-1.1040
1413	56	39	0.0304000	0.	-0.98306	-0.18329	6.4520	-1.1080	-1.0060
1414	1	40	3.0800000	-1.00000	0.	0.			
1415	1	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	0.6870
1416	2	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	0.5870
1417	3	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	0.4870
1418	4	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	0.3870
1419	5	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	0.2870
1420	6	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	0.1870
1421	7	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	0.0870
1422	8	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	-0.0130
1423	9	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	-0.1130
1424	10	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	-0.2130
1425	11	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	-0.3130
1426	12	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	-0.4130
1427	13	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	-0.5130
1428	14	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	-0.6130
1429	15	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	-0.7130
1430	16	41	0.0100000	0.	1.00000	0.	7.4810	1.3720	-0.8130
1431	17	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	0.6870
1432	18	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	0.5870
1433	19	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	0.4870
1434	20	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	0.3870
1435	21	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	0.2870
1436	22	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	0.1870
1437	23	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	0.0870
1438	24	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	-0.0130
1439	25	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	-0.1130
1440	26	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	-0.2130
1441	27	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	-0.3130
1442	28	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	-0.4130
1443	29	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	-0.5130
1444	30	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	-0.6130
1445	31	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	-0.7130
1446	32	41	0.0100000	0.	1.00000	0.	7.3810	1.3720	-0.8130
1447	33	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	0.6870
1448	34	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	0.5870
1449	35	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	0.4870
1450	36	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	0.3870
1451	37	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	0.2870
1452	38	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	0.1870
1453	39	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	0.0870
1454	40	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	-0.0130
1455	41	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	-0.1130
1456	42	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	-0.2130
1457	43	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	-0.3130

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1458	44	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	-0.4130
1459	45	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	-0.5130
1460	46	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	-0.6130
1461	47	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	-0.7130
1462	48	41	0.0100000	0.	1.00000	0.	7.2810	1.3720	-0.8130
1463	49	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	0.6870
1464	50	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	0.5870
1465	51	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	0.4870
1466	52	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	0.3870
1467	53	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	0.2870
1468	54	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	0.1870
1469	55	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	0.0870
1470	56	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	-0.0130
1471	57	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	-0.1130
1472	58	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	-0.2130
1473	59	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	-0.3130
1474	60	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	-0.4130
1475	61	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	-0.5130
1476	62	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	-0.6130
1477	63	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	-0.7130
1478	64	41	0.0100000	0.	1.00000	0.	7.1810	1.3720	-0.8130
1479	65	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	0.6870
1480	66	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	0.5870
1481	67	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	0.4870
1482	68	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	0.3870
1483	69	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	0.2870
1484	70	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	0.1870
1485	71	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	0.0870
1486	72	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	-0.0130
1487	73	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	-0.1130
1488	74	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	-0.2130
1489	75	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	-0.3130
1490	76	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	-0.4130
1491	77	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	-0.5130
1492	78	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	-0.6130
1493	79	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	-0.7130
1494	80	41	0.0100000	0.	1.00000	0.	7.0810	1.3720	-0.8130
1495	81	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	0.6870
1496	82	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	0.5870
1497	83	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	0.4870
1498	84	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	0.3870
1499	85	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	0.2870
1500	86	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	0.1870
1501	87	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	0.0870
1502	88	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	-0.0130
1503	89	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	-0.1130
1504	90	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	-0.2130

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1505	91	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	-0.3130
1506	92	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	-0.4130
1507	93	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	-0.5130
1508	94	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	-0.6130
1509	95	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	-0.7130
1510	96	41	0.0100000	0.	1.00000	0.	6.9810	1.3720	-0.8130
1511	97	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	0.6870
1512	98	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	0.5870
1513	99	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	0.4870
1514	100	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	0.3870
1515	101	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	0.2870
1516	102	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	0.1870
1517	103	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	0.0870
1518	104	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	-0.0130
1519	105	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	-0.1130
1520	106	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	-0.2130
1521	107	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	-0.3130
1522	108	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	-0.4130
1523	109	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	-0.5130
1524	110	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	-0.6130
1525	111	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	-0.7130
1526	112	41	0.0100000	0.	1.00000	0.	6.8810	1.3720	-0.8130
1527	113	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	0.6870
1528	114	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	0.5870
1529	115	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	0.4870
1530	116	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	0.3870
1531	117	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	0.2870
1532	118	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	0.1870
1533	119	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	0.0870
1534	120	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	-0.0130
1535	121	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	-0.1130
1536	122	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	-0.2130
1537	123	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	-0.3130
1538	124	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	-0.4130
1539	125	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	-0.5130
1540	126	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	-0.6130
1541	127	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	-0.7130
1542	128	41	0.0100000	0.	1.00000	0.	6.7810	1.3720	-0.8130
1543	129	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	0.6870
1544	130	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	0.5870
1545	131	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	0.4870
1546	132	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	0.3870
1547	133	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	0.2870
1548	134	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	0.1870
1549	135	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	0.0870
1550	136	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	-0.0130
1551	137	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	-0.1130

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1552	138	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	-0.2130
1553	139	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	-0.3130
1554	140	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	-0.4130
1555	141	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	-0.5130
1556	142	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	-0.6130
1557	143	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	-0.7130
1558	144	41	0.0100000	0.	1.00000	0.	6.6810	1.3720	-0.8130
1559	145	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	0.6870
1560	146	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	0.5870
1561	147	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	0.4870
1562	148	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	0.3870
1563	149	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	0.2870
1564	150	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	0.1870
1565	151	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	0.0870
1566	152	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	-0.0130
1567	153	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	-0.1130
1568	154	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	-0.2130
1569	155	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	-0.3130
1570	156	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	-0.4130
1571	157	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	-0.5130
1572	158	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	-0.6130
1573	159	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	-0.7130
1574	160	41	0.0100000	0.	1.00000	0.	6.5810	1.3720	-0.8130
1575	161	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	0.6870
1576	162	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	0.5870
1577	163	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	0.4870
1578	164	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	0.3870
1579	165	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	0.2870
1580	166	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	0.1870
1581	167	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	0.0870
1582	168	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	-0.0130
1583	169	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	-0.1130
1584	170	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	-0.2130
1585	171	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	-0.3130
1586	172	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	-0.4130
1587	173	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	-0.5130
1588	174	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	-0.6130
1589	175	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	-0.7130
1590	176	41	0.0093000	0.	1.00000	0.	6.4850	1.3720	-0.8130
1591	1	42	0.0033120	-0.34202	-0.93969	0.	6.1750	1.1590	-0.8890
1592	2	42	0.0108556	-0.34202	-0.93969	0.	6.0940	1.1250	-0.9140
1593	3	42	0.0094444	-0.34202	-0.93969	0.	6.0940	1.1250	-1.0080
1594	4	42	0.0108556	-0.34202	-0.93969	0.	5.9940	1.0830	-0.9140
1595	5	42	0.0108556	-0.34202	-0.93969	0.	5.9940	1.0830	-1.0140
1596	6	42	0.0108556	-0.34202	-0.93969	0.	5.9940	1.0830	-1.1140
1597	7	42	0.0059706	-0.34202	-0.93969	0.	5.9940	1.0830	-1.1970
1598	8	42	0.0108556	-0.34202	-0.93969	0.	5.8940	1.0400	-0.9140

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1599	9	42	0.0108556	-0.34202	-0.93969	0.	5.8940	1.0400	-1.0140
1600	10	42	0.0108556	-0.34202	-0.93969	0.	5.8940	1.0400	-1.1140
1601	11	42	0.0108556	-0.34202	-0.93969	0.	5.8940	1.0400	-1.2140
1602	12	42	0.0134609	-0.34202	-0.93969	0.	5.8940	1.0400	-1.3260
1603	13	42	0.0108556	-0.34202	-0.93969	0.	5.7940	0.9980	-0.9140
1604	14	42	0.0108556	-0.34202	-0.93969	0.	5.7940	0.9980	-1.0140
1605	15	42	0.0108556	-0.34202	-0.93969	0.	5.7940	0.9980	-1.1140
1606	16	42	0.0108556	-0.34202	-0.93969	0.	5.7940	0.9980	-1.2140
1607	17	42	0.0108556	-0.34202	-0.93969	0.	5.7940	-0.9980	-1.3140
1608	18	42	0.0108556	-0.34202	-0.93969	0.	5.7940	-0.9980	-1.4140
1609	19	42	0.0100957	-0.34202	-0.93969	0.	5.7940	-0.9980	-1.5100
1610	20	42	0.0108556	-0.34202	-0.93969	0.	5.6940	-0.9560	-0.9140
1611	21	42	0.0108556	-0.34202	-0.93969	0.	5.6940	-0.9560	-1.0140
1612	22	42	0.0108556	-0.34202	-0.93969	0.	5.6940	-0.9560	-1.1140
1613	23	42	0.0108556	-0.34202	-0.93969	0.	5.6940	-0.9560	-1.2140
1614	24	42	0.0108556	-0.34202	-0.93969	0.	5.6940	-0.9560	-1.3140
1615	25	42	0.0108556	-0.34202	-0.93969	0.	5.6940	-0.9560	-1.4140
1616	26	42	0.0108556	-0.34202	-0.93969	0.	5.6940	-0.9560	-1.5140
1617	27	42	0.0108556	-0.34202	-0.93969	0.	5.6940	-0.9560	-1.6140
1618	28	42	0.0055364	-0.34202	-0.93969	0.	5.6940	-0.9560	-1.6900
1619	1	43	0.1400000	-1.00000	0.	0.			
1620	1	44	0.0140010	-0.69993	-0.71421	0.	5.6942	-0.8966	-0.9136
1621	2	44	0.0140010	-0.69993	-0.71421	0.	5.6942	-0.8966	-1.0136
1622	3	44	0.0140010	-0.69993	-0.71421	0.	5.6942	-0.8966	-1.1136
1623	4	44	0.0140010	-0.69993	-0.71421	0.	5.6942	-0.8966	-1.2136
1624	5	44	0.0140010	-0.69993	-0.71421	0.	5.6942	-0.8966	-1.3136
1625	6	44	0.0140010	-0.69993	-0.71421	0.	5.6942	-0.8966	-1.4136
1626	7	44	0.0140010	-0.69993	-0.71421	0.	5.6942	-0.8966	-1.5136
1627	8	44	0.0140010	-0.69993	-0.71421	0.	5.6942	-0.8966	-1.6136
1628	9	44	0.0153030	-0.69993	-0.71421	0.	5.6942	-0.8966	-1.7182
1629	10	44	0.0140010	-0.69993	-0.71421	0.	5.5942	-0.8018	-0.9136
1630	11	44	0.0140010	-0.69993	-0.71421	0.	5.5942	-0.8018	-1.0136
1631	12	44	0.0140010	-0.69993	-0.71421	0.	5.5942	-0.8018	-1.1136
1632	13	44	0.0140010	-0.69993	-0.71421	0.	5.5942	-0.8018	-1.2136
1633	14	44	0.0140010	-0.69993	-0.71421	0.	5.5942	-0.8018	-1.3136
1634	15	44	0.0140010	-0.69993	-0.71421	0.	5.5942	-0.8018	-1.4136
1635	16	44	0.0140010	-0.69993	-0.71421	0.	5.5942	-0.8018	-1.5136
1636	17	44	0.0189150	-0.69993	-0.71421	0.	5.5942	-0.8018	-1.6312
1637	18	44	0.0189000	-0.69993	-0.71421	0.	5.4816	-0.6950	-0.9136
1638	19	44	0.0189000	-0.69993	-0.71421	0.	5.4816	-0.6950	-1.0136
1639	20	44	0.0189000	-0.69993	-0.71421	0.	5.4816	-0.6950	-1.1136
1640	21	44	0.0189000	-0.69993	-0.71421	0.	5.4816	-0.6950	-1.2136
1641	22	44	0.0189000	-0.69993	-0.71421	0.	5.4816	-0.6950	-1.3136
1642	23	44	0.0189000	-0.69993	-0.71421	0.	5.4816	-0.6950	-1.4136
1643	24	44	0.0189000	-0.69993	-0.71421	0.	5.4816	-0.6950	-1.5136
1644	25	44	0.0097100	-0.69993	-0.71421	0.	5.4816	-0.6950	-1.5893
1645	1	45	0.6369200	-0.58778	0.	-0.80902			

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1646	1	46	0.0100000	-1.00000	0.	0.	5.4191	0.5809	-0.9136
1647	2	46	0.0100000	-1.00000	0.	0.	5.4191	0.9809	-0.9136
1648	3	46	0.0100000	-1.00000	0.	0.	5.4191	0.3809	-0.9136
1649	4	46	0.0100000	-1.00000	0.	0.	5.4191	0.2809	-0.9136
1650	5	46	0.0100000	-1.00000	0.	0.	5.4191	0.1809	-0.9136
1651	6	46	0.0100000	-1.00000	0.	0.	5.4191	0.0809	-0.9136
1652	7	46	0.0100000	-1.00000	0.	0.	5.4191	-0.0191	-0.9136
1653	8	46	0.0100000	-1.00000	0.	0.	5.4191	-0.1191	-0.9136
1654	9	46	0.0100000	-1.00000	0.	0.	5.4191	-0.2191	-0.9136
1655	10	46	0.0100000	-1.00000	0.	0.	5.4191	-0.3191	-0.9136
1656	11	46	0.0100000	-1.00000	0.	0.	5.4191	-0.4191	-0.9136
1657	12	46	0.0100000	-1.00000	0.	0.	5.4191	-0.5191	-0.9136
1658	13	46	0.0061800	-1.00000	0.	0.	5.4191	-0.6911	-0.9136
1659	14	46	0.0100000	-1.00000	0.	0.	5.4191	0.5809	-1.0136
1660	15	46	0.0100000	-1.00000	0.	0.	5.4191	0.4809	-1.0136
1661	16	46	0.0100000	-1.00000	0.	0.	5.4191	0.3809	-1.0136
1662	17	46	0.0100000	-1.00000	0.	0.	5.4191	0.2809	-1.0136
1663	18	46	0.0100000	-1.00000	0.	0.	5.4191	0.1809	-1.0136
1664	19	46	0.0100000	-1.00000	0.	0.	5.4191	0.0809	-1.0136
1665	20	46	0.0100000	-1.00000	0.	0.	5.4191	-0.0191	-1.0136
1666	21	46	0.0100000	-1.00000	0.	0.	5.4191	-0.1191	-1.0136
1667	22	46	0.0100000	-1.00000	0.	0.	5.4191	-0.2191	-1.0136
1668	23	46	0.0100000	-1.00000	0.	0.	5.4191	-0.3191	-1.0136
1669	24	46	0.0100000	-1.00000	0.	0.	5.4191	-0.4191	-1.0136
1670	25	46	0.0100000	-1.00000	0.	0.	5.4191	-0.5191	-1.0136
1671	26	46	0.0061800	-1.00000	0.	0.	5.4191	-0.6000	-1.0136
1672	27	46	0.0100000	-1.00000	0.	0.	5.4191	0.5809	-1.1136
1673	28	46	0.0100000	-1.00000	0.	0.	5.4191	0.4809	-1.1136
1674	29	46	0.0100000	-1.00000	0.	0.	5.4191	0.3809	-1.1136
1675	30	46	0.0100000	-1.00000	0.	0.	5.4191	0.2809	-1.1136
1676	31	46	0.0100000	-1.00000	0.	0.	5.4191	0.1809	-1.1136
1677	32	46	0.0100000	-1.00000	0.	0.	5.4191	0.0809	-1.1136
1678	33	46	0.0100000	-1.00000	0.	0.	5.4191	-0.0191	-1.1136
1679	34	46	0.0100000	-1.00000	0.	0.	5.4191	-0.1191	-1.1136
1680	35	46	0.0100000	-1.00000	0.	0.	5.4191	-0.2191	-1.1136
1681	36	46	0.0100000	-1.00000	0.	0.	5.4191	-0.3191	-1.1136
1682	37	46	0.0100000	-1.00000	0.	0.	5.4191	-0.4191	-1.1136
1683	38	46	0.0100000	-1.00000	0.	0.	5.4191	-0.5191	-1.1136
1684	39	46	0.0061800	-1.00000	0.	0.	5.4191	-0.6000	-1.1136
1685	40	46	0.0100000	-1.00000	0.	0.	5.4191	0.5809	-1.2136
1686	41	46	0.0100000	-1.00000	0.	0.	5.4191	0.4809	-1.2136
1687	42	46	0.0100000	-1.00000	0.	0.	5.4191	0.3809	-1.2136
1688	43	46	0.0100000	-1.00000	0.	0.	5.4191	0.2809	-1.2136
1689	44	46	0.0100000	-1.00000	0.	0.	5.4191	0.1809	-1.2136
1690	45	46	0.0100000	-1.00000	0.	0.	5.4191	0.0809	-1.2136
1691	46	46	0.0100000	-1.00000	0.	0.	5.4191	-0.0191	-1.2136
1692	47	46	0.0100000	-1.00000	0.	0.	5.4191	-0.1191	-1.2136

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1693	48	46	0.0100000	-1.00000	0.	0.	5.4191	-0.2191	-1.2136
1694	49	46	0.0100000	-1.00000	0.	0.	5.4191	-0.3191	-1.2136
1695	50	46	0.0100000	-1.00000	0.	0.	5.4191	-0.4191	-1.2136
1696	51	46	0.0100000	-1.00000	0.	0.	5.4191	-0.5191	-1.2136
1697	52	46	0.0061800	-1.00000	0.	0.	5.4191	-0.6000	-1.2136
1698	53	46	0.0100000	-1.00000	0.	0.	5.4191	0.5809	-1.3136
1699	54	46	0.0100000	-1.00000	0.	0.	5.4191	0.4809	-1.3136
1700	55	46	0.0100000	-1.00000	0.	0.	5.4191	0.3809	-1.3136
1701	56	46	0.0100000	-1.00000	0.	0.	5.4191	0.2809	-1.3136
1702	57	46	0.0100000	-1.00000	0.	0.	5.4191	0.1809	-1.3136
1703	58	46	0.0100000	-1.00000	0.	0.	5.4191	0.0809	-1.3136
1704	59	46	0.0100000	-1.00000	0.	0.	5.4191	-0.0191	-1.3136
1705	60	46	0.0100000	-1.00000	0.	0.	5.4191	-0.1191	-1.3136
1706	61	46	0.0100000	-1.00000	0.	0.	5.4191	-0.2191	-1.3136
1707	62	46	0.0100000	-1.00000	0.	0.	5.4191	-0.3191	-1.3136
1708	63	46	0.0100000	-1.00000	0.	0.	5.4191	-0.4191	-1.3136
1709	64	46	0.0100000	-1.00000	0.	0.	5.4191	-0.5191	-1.3136
1710	65	46	0.0061800	-1.00000	0.	0.	5.4191	-0.6000	-1.3136
1711	66	46	0.0100000	-1.00000	0.	0.	5.4191	0.5809	-1.4136
1712	67	46	0.0100000	-1.00000	0.	0.	5.4191	0.4809	-1.4136
1713	68	46	0.0100000	-1.00000	0.	0.	5.4191	0.3809	-1.4136
1714	69	46	0.0100000	-1.00000	0.	0.	5.4191	0.2809	-1.4136
1715	70	46	0.0100000	-1.00000	0.	0.	5.4191	0.1809	-1.4136
1716	71	46	0.0100000	-1.00000	0.	0.	5.4191	0.0809	-1.4136
1717	72	46	0.0100000	-1.00000	0.	0.	5.4191	-0.0191	-1.4136
1718	73	46	0.0100000	-1.00000	0.	0.	5.4191	-0.1191	-1.4136
1719	74	46	0.0100000	-1.00000	0.	0.	5.4191	-0.2191	-1.4136
1720	75	46	0.0100000	-1.00000	0.	0.	5.4191	-0.3191	-1.4136
1721	76	46	0.0100000	-1.00000	0.	0.	5.4191	-0.4191	-1.4136
1722	77	46	0.0100000	-1.00000	0.	0.	5.4191	-0.5191	-1.4136
1723	78	46	0.0061800	-1.00000	0.	0.	5.4191	-0.6000	-1.4136
1724	79	46	0.0104900	-1.00000	0.	0.	5.4191	0.5809	-1.5160
1725	80	46	0.0104900	-1.00000	0.	0.	5.4191	0.4809	-1.5160
1726	81	46	0.0104900	-1.00000	0.	0.	5.4191	0.3809	-1.5160
1727	82	46	0.0104900	-1.00000	0.	0.	5.4191	0.2809	-1.5160
1728	83	46	0.0104900	-1.00000	0.	0.	5.4191	0.1809	-1.5160
1729	84	46	0.0104900	-1.00000	0.	0.	5.4191	0.0809	-1.5160
1730	85	46	0.0104900	-1.00000	0.	0.	5.4191	-0.0191	-1.5160
1731	86	46	0.0104900	-1.00000	0.	0.	5.4191	-0.1191	-1.5160
1732	87	46	0.0104900	-1.00000	0.	0.	5.4191	-0.2191	-1.5160
1733	88	46	0.0104900	-1.00000	0.	0.	5.4191	-0.3191	-1.5160
1734	89	46	0.0104900	-1.00000	0.	0.	5.4191	-0.4191	-1.5160
1735	90	46	0.0104900	-1.00000	0.	0.	5.4191	-0.5191	-1.5160
1736	91	46	0.0064830	-1.00000	0.	0.	5.4191	-0.6000	-1.5160
1737	1	47	0.0140010	-0.69993	0.71421	0.	5.6942	0.8966	-0.9136
1738	2	47	0.0140010	-0.69993	0.71421	0.	5.6942	0.8966	-1.0136
1739	3	47	0.0140010	-0.69993	0.71421	0.	5.6942	0.8966	-1.1136

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1740	4	47	0.0140010	-0.69993	0.71421	0.	5.6942	0.8966	-1.2136
1741	5	47	0.0140010	-0.69993	0.71421	0.	5.6942	0.8966	-1.3136
1742	6	47	0.0140010	-0.69993	0.71421	0.	5.6942	0.8966	-1.4136
1743	7	47	0.0140010	-0.69993	0.71421	0.	5.6942	0.8966	-1.5136
1744	8	47	0.0140010	-0.69993	0.71421	0.	5.6942	0.8966	-1.6136
1745	9	47	0.0153030	-0.69993	0.71421	0.	5.6942	0.8966	-1.7182
1746	10	47	0.0140010	-0.69993	0.71421	0.	5.5942	0.8018	-0.9136
1747	11	47	0.0140010	-0.69993	0.71421	0.	5.5942	0.8018	-1.0136
1748	12	47	0.0140010	-0.69993	0.71421	0.	5.5942	0.8018	-1.1136
1749	13	47	0.0140010	-0.69993	0.71421	0.	5.5942	0.8018	-1.2136
1750	14	47	0.0140010	-0.69993	0.71421	0.	5.5942	0.8018	-1.3136
1751	15	47	0.0140010	-0.69993	0.71421	0.	5.5942	0.8018	-1.4136
1752	16	47	0.0140010	-0.69993	0.71421	0.	5.5942	0.8018	-1.5136
1753	17	47	0.0189150	-0.69993	0.71421	0.	5.5942	0.8018	-1.6312
1754	18	47	0.0189000	-0.69993	0.71421	0.	5.4816	0.6950	-0.9136
1755	19	47	0.0189000	-0.69993	0.71421	0.	5.4816	0.6950	-1.0136
1756	20	47	0.0189000	-0.69993	0.71421	0.	5.4816	0.6950	-1.1136
1757	21	47	0.0189000	-0.69993	0.71421	0.	5.4816	0.6950	-1.2136
1758	22	47	0.0189000	-0.69993	0.71421	0.	5.4816	0.6950	-1.3136
1759	23	47	0.0189000	-0.69993	0.71421	0.	5.4816	0.6950	-1.4136
1760	24	47	0.0189000	-0.69993	0.71421	0.	5.4816	0.6950	-1.5136
1761	25	47	0.0097100	-0.69993	0.71421	0.	5.4816	0.6950	-1.5893
1762	1	48	0.0033120	-0.34202	0.93969	0.	6.1750	-1.1590	-0.8890
1763	2	48	0.0108556	-0.34202	0.93969	0.	6.0940	-1.1250	-0.9140
1764	3	48	0.0094444	-0.34202	0.93969	0.	6.0940	-1.1250	-1.0080
1765	4	48	0.0108556	-0.34202	0.93969	0.	5.9940	-1.0830	-0.9140
1766	5	48	0.0108556	-0.34202	0.93969	0.	5.9940	-1.0830	-1.0140
1767	6	48	0.0108556	-0.34202	0.93969	0.	5.9940	-1.0830	-1.1140
1768	7	48	0.0059706	-0.34202	0.93969	0.	5.9940	-1.0830	-1.1970
1769	8	48	0.0108556	-0.34202	0.93969	0.	5.8940	-1.0400	-0.9140
1770	9	48	0.0108556	-0.34202	0.93969	0.	5.8940	-1.0400	-1.0140
1771	10	48	0.0108556	-0.34202	0.93969	0.	5.8940	-1.0400	-1.1140
1772	11	48	0.0108556	-0.34202	0.93969	0.	5.8940	-1.0400	-1.2140
1773	12	48	0.0134609	-0.34202	0.93969	0.	5.8940	-1.0400	-1.3260
1774	13	48	0.0108556	-0.34202	0.93969	0.	5.7940	0.9980	-0.9140
1775	14	48	0.0108556	-0.34202	0.93969	0.	5.7940	0.9980	-1.0140
1776	15	48	0.0108556	-0.34202	0.93969	0.	5.7940	0.9980	-1.1140
1777	16	48	0.0108556	-0.34202	0.93969	0.	5.7940	0.9980	-1.2140
1778	17	48	0.0108556	-0.34202	0.93969	0.	5.7940	0.9980	-1.3140
1779	18	48	0.0108556	-0.34202	0.93969	0.	5.7940	0.9980	-1.4140
1780	19	48	0.0100957	-0.34202	0.93969	0.	5.7940	0.9980	-1.5100
1781	20	48	0.0108556	-0.34202	0.93969	0.	5.6940	0.9560	-0.9140
1782	21	48	0.0108556	-0.34202	0.93969	0.	5.6940	0.9560	-1.0140
1783	22	48	0.0108556	-0.34202	0.93969	0.	5.6940	0.9560	-1.1140
1784	23	48	0.0108556	-0.34202	0.93969	0.	5.6940	0.9560	-1.2140
1785	24	48	0.0108556	-0.34202	0.93969	0.	5.6940	0.9560	-1.3140
1786	25	48	0.0108556	-0.34202	0.93969	0.	5.6940	0.9560	-1.4140



TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1787	26	48	0.0108556	-0.34202	0.93969	0.	5.6940	0.9560	-1.5140
1788	27	48	0.0108556	-0.34202	0.93969	0.	5.6940	0.9560	-1.6140
1789	28	48	0.0055364	-0.34202	0.93969	0.	5.6940	0.9560	-1.6900
1790	1	49	0.0056000	0.	0.98306	-0.18329	7.0520	0.9810	-1.6920
1791	2	49	0.0100000	0.	0.98306	-0.18329	6.9520	0.9810	-1.6920
1792	3	49	0.0100000	0.	0.98306	-0.18329	6.8520	0.9810	-1.6920
1793	4	49	0.0100000	0.	0.98306	-0.18329	6.7520	0.9810	-1.6920
1794	5	49	0.0100000	0.	0.98306	-0.18329	6.6520	0.9810	-1.6920
1795	6	49	0.0100000	0.	0.98306	-0.18329	6.5520	0.9810	-1.6920
1796	7	49	0.0100000	0.	0.98306	-0.18329	6.4520	0.9810	-1.6920
1797	8	49	0.0100000	0.	0.98306	-0.18329	6.3520	0.9810	-1.6920
1798	9	49	0.0100000	0.	0.98306	-0.18329	6.2520	0.9810	-1.6920
1799	10	49	0.0100000	0.	0.98306	-0.18329	6.1520	0.9810	-1.6920
1800	11	49	0.0100000	0.	0.98306	-0.18329	6.0520	0.9810	-1.6920
1801	12	49	0.0100000	0.	0.98306	-0.18329	5.9520	0.9810	-1.6920
1802	13	49	0.0056000	0.	0.98306	-0.18329	5.8520	0.9810	-1.6920
1803	14	49	0.0081000	0.	0.98306	-0.18329	6.9520	0.9990	-1.5940
1804	15	49	0.0100000	0.	0.98306	-0.18329	6.8520	0.9990	-1.5940
1805	16	49	0.0100000	0.	0.98306	-0.18329	6.7520	0.9990	-1.5940
1806	17	49	0.0100000	0.	0.98306	-0.18329	6.6520	0.9990	-1.5940
1807	18	49	0.0100000	0.	0.98306	-0.18329	6.5520	0.9990	-1.5940
1808	19	49	0.0100000	0.	0.98306	-0.18329	6.4520	0.9990	-1.5940
1809	20	49	0.0100000	0.	0.98306	-0.18329	6.3520	0.9990	-1.5940
1810	21	49	0.0100000	0.	0.98306	-0.18329	6.2520	0.9990	-1.5940
1811	22	49	0.0100000	0.	0.98306	-0.18329	6.1520	0.9990	-1.5940
1812	23	49	0.0100000	0.	0.98306	-0.18329	6.0520	0.9990	-1.5940
1813	24	49	0.0081000	0.	0.98306	-0.18329	5.9520	0.9990	-1.5940
1814	25	49	0.0105000	0.	0.98306	-0.18329	6.8520	1.0170	-1.4960
1815	26	49	0.0100000	0.	0.98306	-0.18329	6.7520	1.0170	-1.4960
1816	27	49	0.0100000	0.	0.98306	-0.18329	6.6520	1.0170	-1.4960
1817	28	49	0.0100000	0.	0.98306	-0.18329	6.5520	1.0170	-1.4960
1818	29	49	0.0100000	0.	0.98306	-0.18329	6.4520	1.0170	-1.4960
1819	30	49	0.0100000	0.	0.98306	-0.18329	6.3520	1.0170	-1.4960
1820	31	49	0.0100000	0.	0.98306	-0.18329	6.2520	1.0170	-1.4960
1821	32	49	0.0100000	0.	0.98306	-0.18329	6.1520	1.0170	-1.4960
1822	33	49	0.0105000	0.	0.98306	-0.18329	6.0520	1.0170	-1.4960
1823	34	49	0.0129000	0.	0.98306	-0.18329	6.7520	1.0350	-1.3980
1824	35	49	0.0100000	0.	0.98306	-0.18329	6.6520	1.0350	-1.3980
1825	36	49	0.0100000	0.	0.98306	-0.18329	6.5520	1.0350	-1.3980
1826	37	49	0.0100000	0.	0.98306	-0.18329	6.4520	1.0350	-1.3980
1827	38	49	0.0100000	0.	0.98306	-0.18329	6.3520	1.0350	-1.3980
1828	39	49	0.0100000	0.	0.98306	-0.18329	6.2520	1.0350	-1.3980
1829	40	49	0.0129000	0.	0.98306	-0.18329	6.1520	1.0350	-1.3980
1830	41	49	0.0053000	0.	0.98306	-0.18329	6.7520	1.0540	-1.3000
1831	42	49	0.0100000	0.	0.98306	-0.18329	6.6520	1.0540	-1.3000
1832	43	49	0.0100000	0.	0.98306	-0.18329	6.5520	1.0540	-1.3000
1833	44	49	0.0100000	0.	0.98306	-0.18329	6.4520	1.0540	-1.3000

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1834	45	49	0.0100000	0.	0.98306	-0.18329	6.3520	1.0540	-1.3000
1835	46	49	0.0100000	0.	0.98306	-0.18329	6.2520	1.0540	-1.3000
1836	47	49	0.0053000	0.	0.98306	-0.18329	6.1520	1.0540	-1.3000
1837	48	49	0.0077000	0.	0.98306	-0.18329	6.6520	1.0720	-1.2020
1838	49	49	0.0100000	0.	0.98306	-0.18329	6.5520	1.0720	-1.2020
1839	50	49	0.0100000	0.	0.98306	-0.18329	6.4520	1.0720	-1.2020
1840	51	49	0.0100000	0.	0.98306	-0.18329	6.3520	1.0720	-1.2020
1841	52	49	0.0077000	0.	0.98306	-0.18329	6.2520	1.0720	-1.2020
1842	53	49	0.0102000	0.	0.98306	-0.18329	6.5520	1.0900	-1.1040
1843	54	49	0.0100000	0.	0.98306	-0.18329	6.4520	1.0900	-1.1040
1844	55	49	0.0102000	0.	0.98306	-0.18329	6.3520	1.0900	-1.1040
1845	56	49	0.0304000	0.	0.98306	-0.18329	6.4520	1.1080	-1.0060
1846	1	50	0.0100000	0.	0.	-1.00000	7.8875	-0.3882	-0.8636
1847	2	50	0.0100000	0.	0.	-1.00000	7.8875	-0.2882	-0.8636
1848	3	50	0.0100000	0.	0.	-1.00000	7.8875	-0.1882	-0.8636
1849	4	50	0.0100000	0.	0.	-1.00000	7.8875	-0.0882	-0.8636
1850	5	50	0.0100000	0.	0.	-1.00000	7.8875	0.0118	-0.8636
1851	6	50	0.0100000	0.	0.	-1.00000	7.8875	0.1118	-0.8636
1852	7	50	0.0100000	0.	0.	-1.00000	7.8875	0.2118	-0.8636
1853	8	50	0.0100000	0.	0.	-1.00000	7.8875	0.3118	-0.8636
1854	9	50	0.0076400	0.	0.	-1.00000	7.8875	0.4000	-0.8636
1855	10	50	0.0100000	0.	0.	-1.00000	7.7875	-0.3882	-0.8636
1856	11	50	0.0100000	0.	0.	-1.00000	7.7875	-0.2882	-0.8636
1857	12	50	0.0100000	0.	0.	-1.00000	7.7875	-0.1882	-0.8636
1858	13	50	0.0100000	0.	0.	-1.00000	7.7875	-0.0882	-0.8636
1859	14	50	0.0100000	0.	0.	-1.00000	7.7875	0.0118	-0.8636
1860	15	50	0.0100000	0.	0.	-1.00000	7.7875	0.1118	-0.8636
1861	16	50	0.0100000	0.	0.	-1.00000	7.7875	0.2118	-0.8636
1862	17	50	0.0100000	0.	0.	-1.00000	7.7875	0.3118	-0.8636
1863	18	50	0.0076400	0.	0.	-1.00000	7.7875	0.4000	-0.8636
1864	19	50	0.0126400	0.	0.	-1.00000	7.6743	-0.3882	-0.8636
1865	20	50	0.0126400	0.	0.	-1.00000	7.6743	-0.2882	-0.8636
1866	21	50	0.0126400	0.	0.	-1.00000	7.6743	-0.1882	-0.8636
1867	22	50	0.0126400	0.	0.	-1.00000	7.6743	-0.0882	-0.8636
1868	23	50	0.0126400	0.	0.	-1.00000	7.6743	0.0118	-0.8636
1869	24	50	0.0126400	0.	0.	-1.00000	7.6743	0.1118	-0.8636
1870	25	50	0.0126400	0.	0.	-1.00000	7.6743	0.2118	-0.8636
1871	26	50	0.0126400	0.	0.	-1.00000	7.6743	0.3118	-0.8636
1872	27	50	0.0096570	0.	0.	-1.00000	7.6743	0.4000	-0.8636
1873	1	51	0.0108556	0.34202	0.93969	0.	7.0440	0.9560	-0.9140
1874	2	51	0.0108556	0.34202	0.93969	0.	7.0440	0.9560	-1.0140
1875	3	51	0.0108556	0.34202	0.93969	0.	7.0440	0.9560	-1.1140
1876	4	51	0.0108556	0.34202	0.93969	0.	7.0440	0.9560	-1.2140
1877	5	51	0.0108556	0.34202	0.93969	0.	7.0440	0.9560	-1.3140
1878	6	51	0.0108556	0.34202	0.93969	0.	7.0440	0.9560	-1.4140
1879	7	51	0.0108556	0.34202	0.93969	0.	7.0440	0.9560	-1.5140
1880	8	51	0.0108556	0.34202	0.93969	0.	7.0440	0.9560	-1.6140

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1881	9	51	0.0055364	0.34202	0.93969	0.	7.0440	0.9560	-1.6900
1882	10	51	0.0108556	0.34202	0.93969	0.	6.9440	0.9980	-0.9140
1883	11	51	0.0108556	0.34202	0.93969	0.	6.9440	0.9980	-1.0140
1884	12	51	0.0108556	0.34202	0.93969	0.	6.9440	0.9980	-1.1140
1885	13	51	0.0108556	0.34202	0.93969	0.	6.9440	0.9980	-1.2140
1886	14	51	0.0108556	0.34202	0.93969	0.	6.9440	0.9980	-1.3140
1887	15	51	0.0108556	0.34202	0.93969	0.	6.9440	0.9980	-1.4140
1888	16	51	0.0100957	0.34202	0.93969	0.	6.9440	0.9980	-1.5100
1889	17	51	0.0108556	0.34202	0.93969	0.	6.8440	1.0400	-0.9140
1890	18	51	0.0108556	0.34202	0.93969	0.	6.8440	1.0400	-1.0140
1891	19	51	0.0108556	0.34202	0.93969	0.	6.8440	1.0400	-1.1140
1892	20	51	0.0108556	0.34202	0.93969	0.	6.8440	1.0400	-1.2140
1893	21	51	0.0134609	0.34202	0.93969	0.	6.8440	1.0400	-1.3260
1894	22	51	0.0108556	0.34202	0.93969	0.	6.7440	1.0830	-0.9140
1895	23	51	0.0108556	0.34202	0.93969	0.	6.7440	1.0830	-1.0140
1896	24	51	0.0108556	0.34202	0.93969	0.	6.7440	1.0830	-1.1140
1897	25	51	0.0059706	0.34202	0.93969	0.	6.7440	1.0830	-1.1920
1898	26	51	0.0108556	0.34202	0.93969	0.	6.6440	1.1250	-0.9140
1899	27	51	0.0094444	0.34202	0.93969	0.	6.6440	1.1250	-1.0080
1900	28	51	0.0033110	0.34202	0.93969	0.	6.5630	1.1590	-0.8890
1901	1	52	0.0140700	0.72084	0.69310	0.	7.4690	0.5636	-0.9140
1902	2	52	0.0015500	0.72084	0.69310	0.	7.4690	0.5636	-0.9695
1903	3	52	0.0140700	0.72084	0.69310	0.	7.3690	0.6626	-0.9140
1904	4	52	0.0140700	0.72084	0.69310	0.	7.3690	0.6626	-1.0140
1905	5	52	0.0185700	0.72084	0.69310	0.	7.3690	0.6626	-1.1300
1906	6	52	0.0140700	0.72084	0.69310	0.	7.2690	0.7616	-0.9140
1907	7	52	0.0140700	0.72084	0.69310	0.	7.2690	0.7616	-1.0140
1908	8	52	0.0140700	0.72084	0.69310	0.	7.2690	0.7616	-1.1490
1909	9	52	0.0140700	0.72084	0.69310	0.	7.2690	0.7616	-1.2140
1910	10	52	0.0140700	0.72084	0.69310	0.	7.2690	0.7616	-1.3140
1911	11	52	0.0078800	0.72084	0.69310	0.	7.2690	0.7616	-1.3920
1912	12	52	0.0140700	0.72084	0.69310	0.	7.1690	0.8606	-0.9140
1913	13	52	0.0140700	0.72084	0.69310	0.	7.1690	0.8606	-1.0140
1914	14	52	0.0140700	0.72084	0.69310	0.	7.1690	0.8606	-1.1140
1915	15	52	0.0140700	0.72084	0.69310	0.	7.1690	0.8606	-1.2140
1916	16	52	0.0140700	0.72084	0.69310	0.	7.1690	0.8606	-1.3140
1917	17	52	0.0140700	0.72084	0.69310	0.	7.1690	0.8606	-1.4140
1918	18	52	0.0140700	0.72084	0.69310	0.	7.1690	0.8606	-1.5140
1919	19	52	0.0111100	0.72084	0.69310	0.	7.1690	0.8606	-1.6040
1920	20	52	0.0035200	0.72084	0.69310	0.	7.1060	0.9236	-0.9140
1921	21	52	0.0035200	0.72084	0.69310	0.	7.1060	0.9236	-1.0140
1922	22	52	0.0035200	0.72084	0.69310	0.	7.1060	0.9236	-1.1140
1923	23	52	0.0035200	0.72084	0.69310	0.	7.1060	0.9236	-1.2140
1924	24	52	0.0035200	0.72084	0.69310	0.	7.1060	0.9236	-1.3140
1925	25	52	0.0035200	0.72084	0.69310	0.	7.1060	0.9236	-1.4140
1926	26	52	0.0035200	0.72084	0.69310	0.	7.1060	0.9236	-1.5140
1927	27	52	0.0035200	0.72084	0.69310	0.	7.1060	0.9236	-1.6140

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1928	28	52	0.0041900	0.72084	0.69310	0.	7.1060	0.9236	-1.7240
1929	1	53	0.3395000	0.96593	0.	-0.25882			
1930	1	54	0.0100000	0.10934	0.99400	0.	7.7478	0.2910	2.1400
1931	2	54	0.0100000	0.10934	0.99400	0.	7.7478	0.2910	2.0400
1932	3	54	0.0100000	0.10934	0.99400	0.	7.7478	0.2910	1.9400
1933	4	54	0.0100000	0.10934	0.99400	0.	7.7478	0.2910	1.8400
1934	5	54	0.0100000	0.10934	0.99400	0.	7.7478	0.2910	1.7400
1935	6	54	0.0100000	0.10934	0.99400	0.	7.7478	0.2910	1.6400
1936	7	54	0.0100000	0.10934	0.99400	0.	7.7478	0.2910	1.5400
1937	8	54	0.0100000	0.10934	0.99400	0.	7.7478	0.2910	1.4400
1938	9	54	0.0100000	0.10934	0.99400	0.	7.7478	0.2910	1.3400
1939	10	54	0.0100000	0.10934	0.99400	0.	7.7478	0.2910	1.2400
1940	11	54	0.0100000	0.10934	0.99400	0.	7.7478	0.2910	1.1400
1941	12	54	0.0100000	0.10934	0.99400	0.	7.7478	0.2910	1.0400
1942	13	54	0.0100000	0.10934	0.99400	0.	7.7478	0.2910	0.9400
1943	14	54	0.0100000	0.10934	0.99400	0.	7.7478	0.2910	0.8400
1944	15	54	0.0052400	0.10934	0.99400	0.	7.7478	0.2910	0.7640
1945	16	54	0.0086710	0.10934	0.99400	0.	7.6545	0.3030	2.1400
1946	17	54	0.0086710	0.10934	0.99400	0.	7.6545	0.3030	2.0400
1947	18	54	0.0086710	0.10934	0.99400	0.	7.6545	0.3030	1.9400
1948	19	54	0.0086710	0.10934	0.99400	0.	7.6545	0.3030	1.8400
1949	20	54	0.0086710	0.10934	0.99400	0.	7.6545	0.3030	1.7400
1950	21	54	0.0086710	0.10934	0.99400	0.	7.6545	0.3030	1.6400
1951	22	54	0.0086710	0.10934	0.99400	0.	7.6545	0.3030	1.5400
1952	23	54	0.0086710	0.10934	0.99400	0.	7.6545	0.3030	1.4400
1953	24	54	0.0086710	0.10934	0.99400	0.	7.6545	0.3030	1.3400
1954	25	54	0.0086710	0.10934	0.99400	0.	7.6545	0.3030	1.2400
1955	26	54	0.0086710	0.10934	0.99400	0.	7.6545	0.3030	1.1400
1956	27	54	0.0086710	0.10934	0.99400	0.	7.6545	0.3030	1.0400
1957	28	54	0.0086710	0.10934	0.99400	0.	7.6545	0.3030	0.9400
1958	29	54	0.0086710	0.10934	0.99400	0.	7.6545	0.3030	0.8400
1959	30	54	0.0045400	0.10934	0.99400	0.	7.6545	0.3030	0.7640
1960	31	54	0.0100524	0.10934	0.99400	0.	7.9630	0.2670	0.9450
1961	32	54	0.0100524	0.10934	0.99400	0.	7.9630	0.2670	1.0450
1962	33	54	0.0100524	0.10934	0.99400	0.	7.9630	0.2670	1.1450
1963	34	54	0.0116608	0.10934	0.99400	0.	7.9630	0.2670	1.2530
1964	35	54	0.0115603	0.10934	0.99400	0.	7.8555	0.2790	0.7870
1965	36	54	0.0115603	0.10934	0.99400	0.	7.8555	0.2790	0.8870
1966	37	54	0.0115603	0.10934	0.99400	0.	7.8555	0.2790	0.9870
1967	38	54	0.0115603	0.10934	0.99400	0.	7.8555	0.2790	1.0870
1968	39	54	0.0115603	0.10934	0.99400	0.	7.8555	0.2790	1.1870
1969	40	54	0.0115603	0.10934	0.99400	0.	7.8555	0.2790	1.2870
1970	41	54	0.0115603	0.10934	0.99400	0.	7.8555	0.2790	1.3870
1971	42	54	0.0115603	0.10934	0.99400	0.	7.8555	0.2790	1.4870
1972	43	54	0.0115603	0.10934	0.99400	0.	7.8555	0.2790	1.5870
1973	44	54	0.0108667	0.10934	0.99400	0.	7.8555	0.2790	1.6840
1974	1	55	0.6029000	0.	-0.93178	-0.36303			

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
1975	1	56	0.4503000	0.	-0.93146	0.36385			
1976	1	57	1.2200000	-0.96593	0.25882	0.			
1977	1	58	0.1510000	0.	0.	1.00000			
1978	1	59	0.1135000	0.99619	-0.08716	0.			
1979	2	59	0.1135000	0.96593	-0.25882	0.			
1980	3	59	0.1135000	0.90631	-0.42262	0.			
1981	4	59	0.1135000	0.81915	-0.57358	0.			
1982	5	59	0.1135000	0.70711	-0.70711	0.			
1983	6	59	0.1135000	0.57358	-0.81915	0.			
1984	7	59	0.1135000	0.42262	-0.90631	0.			
1985	8	59	0.1135000	0.25882	-0.96593	0.			
1986	9	59	0.1135000	0.08716	-0.99619	0.			
1987	1	60	0.1135000	0.99619	0.08716	0.			
1988	2	60	0.1135000	0.96593	0.25882	0.			
1989	3	60	0.1135000	0.90631	0.42262	0.			
1990	4	60	0.1135000	0.81915	0.57358	0.			
1991	5	60	0.1135000	0.70711	0.70711	0.			
1992	6	60	0.1135000	0.57358	0.81915	0.			
1993	7	60	0.1135000	0.42262	0.90631	0.			
1994	8	60	0.1135000	0.25882	0.96593	0.			
1995	9	60	0.1135000	0.08716	0.99619	0.			
1996	1	61	0.1952000	-0.76604	-0.64279	0.			
1997	2	61	0.1952000	-0.86603	-0.50000	0.			
1998	3	61	0.1952000	-0.93969	-0.34202	0.			
1999	4	61	0.1952000	-0.98481	-0.17365	0.			
2000	5	61	0.1952000	-1.00000	0.	0.			
2001	6	61	0.1952000	-0.98481	0.17365	0.			
2002	7	61	0.1564000	-0.93969	0.34202	0.			
2003	8	61	0.1564000	-0.86603	0.50000	0.			
2004	9	61	0.1564000	-0.76604	0.64279	0.			
2005	10	61	0.1952000	-0.64279	0.76604	0.			
2006	11	61	0.1952000	-0.50000	0.86603	0.			
2007	12	61	0.1952000	-0.34202	0.93969	0.			
2008	13	61	0.1952000	-0.17365	0.98481	0.			
2009	14	61	0.1952000	0.	1.00000	0.			
2010	15	61	0.1952000	0.17365	0.98481	0.			
2011	16	61	0.1952000	0.34202	0.93969	0.			
2012	17	61	0.1952000	0.50000	0.86603	0.			
2013	18	61	0.1952000	0.64279	0.76604	0.			
2014	19	61	0.1952000	0.76604	0.64279	0.			
2015	20	61	0.2098000	0.87250	0.48862	0.			
2016	1	62	0.1952000	0.95293	0.30320	0.			
2017	2	62	0.1952000	0.99110	0.13312	0.			
2018	3	62	0.1952000	0.99916	-0.04100	0.			
2019	4	62	0.1952000	0.97686	-0.21388	0.			
2020	5	62	0.1952000	0.92488	-0.38026	0.			
2021	6	62	0.1952000	0.84480	-0.53509	0.			

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
2022	7	62	0.1952000	0.73904	-0.67366	0.			
2023	8	62	0.1368000	0.61084	-0.79176	0.			
2024	9	62	0.0969000	0.46407	-0.88580	0.			
2025	10	62	0.0616000	0.30320	-0.95293	0.			
2026	11	62	0.0445000	0.13312	-0.99110	0.			
2027	12	62	0.0353000	-0.04100	-0.99916	0.			
2028	13	62	0.0399000	-0.21388	-0.97686	0.			
2029	14	62	0.0502000	-0.38026	-0.92488	0.			
2030	15	62	0.0787000	-0.53509	-0.84480	0.			
2031	16	62	0.1174000	-0.67366	-0.73904	0.			
2032	17	62	0.1952000	-0.79176	-0.61084	0.			
2033	18	62	0.1952000	-0.88580	-0.46407	0.			
2034	19	62	0.1952000	-0.95293	-0.30320	0.			
2035	20	62	0.1952000	-0.99110	-0.13312	0.			
2036	21	62	0.1952000	-0.99916	0.04100	0.			
2037	22	62	0.1578000	-0.98347	0.18109	0.			
2038	1	63	0.0066500	0.95341	-0.30168	0.	7.5874	-0.3755	1.7243
2039	2	63	0.0066500	0.95341	-0.30168	0.	7.5874	-0.3755	1.6243
2040	3	63	0.0066500	0.95341	-0.30168	0.	7.5874	-0.3755	1.5243
2041	4	63	0.0066500	0.95341	-0.30168	0.	7.5874	-0.3755	1.4243
2042	5	63	0.0066500	0.95341	-0.30168	0.	7.5874	-0.3755	1.3243
2043	6	63	0.0066500	0.95341	-0.30168	0.	7.5874	-0.3755	1.2243
2044	7	63	0.0066500	0.95341	-0.30168	0.	7.5874	-0.3755	1.1243
2045	8	63	0.0066500	0.95341	-0.30168	0.	7.5874	-0.3755	1.0243
2046	9	63	0.0066500	0.95341	-0.30168	0.	7.5874	-0.3755	0.9243
2047	10	63	0.0091300	0.95341	-0.30168	0.	7.5874	-0.3755	0.8057
2048	11	63	0.0135200	0.90631	-0.42262	0.	7.5288	-0.5260	1.6677
2049	12	63	0.0135200	0.90631	-0.42262	0.	7.5288	-0.5260	1.5677
2050	13	63	0.0135200	0.90631	-0.42262	0.	7.5288	-0.5260	1.4677
2051	14	63	0.0135200	0.90631	-0.42262	0.	7.5288	-0.5260	1.3677
2052	15	63	0.0135200	0.90631	-0.42262	0.	7.5288	-0.5260	1.2677
2053	16	63	0.0135200	0.90631	-0.42262	0.	7.5288	-0.5260	1.1677
2054	17	63	0.0135200	0.90631	-0.42262	0.	7.5288	-0.5260	1.0677
2055	18	63	0.0135200	0.90631	-0.42262	0.	7.5288	-0.5260	0.9677
2056	19	63	0.0135200	0.90631	-0.42262	0.	7.5288	-0.5260	0.8677
2057	20	63	0.0109100	0.90631	-0.42262	0.	7.5288	-0.5260	0.7774
2058	21	63	0.0135200	0.81915	-0.57358	0.	7.4203	-0.7139	1.5609
2059	22	63	0.0135200	0.81915	-0.57358	0.	7.4203	-0.7139	1.4609
2060	23	63	0.0135200	0.81915	-0.57358	0.	7.4203	-0.7139	1.3609
2061	24	63	0.0135200	0.81915	-0.57358	0.	7.4203	-0.7139	1.2609
2062	25	63	0.0135200	0.81915	-0.57358	0.	7.4203	-0.7139	1.1609
2063	26	63	0.0135200	0.81915	-0.57358	0.	7.4203	-0.7139	1.0609
2064	27	63	0.0135200	0.81915	-0.57358	0.	7.4203	-0.7139	0.9609
2065	28	63	0.0135200	0.81915	-0.57358	0.	7.4203	-0.7139	0.8609
2066	29	63	0.0099900	0.81915	-0.57358	0.	7.4203	-0.7139	0.7740
2067	30	63	0.0135200	0.70711	-0.70711	0.	7.2809	-0.8801	1.4282
2068	31	63	0.0135200	0.70711	-0.70711	0.	7.2809	-0.8801	1.3282

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
2069	32	63	0.0135200	0.70711	-0.70711	0.	7.2809	-0.8801	1.2282
2070	33	63	0.0135200	0.70711	-0.70711	0.	7.2809	-0.8801	1.1282
2071	34	63	0.0135200	0.70711	-0.70711	0.	7.2809	-0.8801	1.0282
2072	35	63	0.0135200	0.70711	-0.70711	0.	7.2809	-0.8801	0.9282
2073	36	63	0.0190900	0.70711	-0.70711	0.	7.2809	-0.8801	0.8076
2074	37	63	0.0135200	0.57358	-0.81915	0.	7.1147	-1.0193	1.2676
2075	38	63	0.0135200	0.57358	-0.81915	0.	7.1147	-1.0193	1.1676
2076	39	63	0.0135200	0.57358	-0.81915	0.	7.1147	-1.0193	1.0676
2077	40	63	0.0135200	0.57358	-0.81915	0.	7.1147	-1.0193	0.9676
2078	41	63	0.0135200	0.57358	-0.81915	0.	7.1147	-1.0193	0.8676
2079	42	63	0.0109000	0.57358	-0.81915	0.	7.1147	-1.0193	0.7773
2080	43	63	0.0135200	0.42262	-0.90631	0.	6.9268	-1.1280	1.3602
2081	44	63	0.0135200	0.42262	-0.90631	0.	6.9268	-1.1280	1.2602
2082	45	63	0.0135200	0.42262	-0.90631	0.	6.9268	-1.1280	1.1602
2083	46	63	0.0135200	0.42262	-0.90631	0.	6.9268	-1.1280	1.0602
2084	47	63	0.0135200	0.42262	-0.90631	0.	6.9268	-1.1280	0.9602
2085	48	63	0.0135200	0.42262	-0.90631	0.	6.9268	-1.1280	0.8602
2086	49	63	0.0099000	0.42262	-0.90631	0.	6.9268	-1.1280	0.7736
2087	50	63	0.0135200	0.25882	-0.96593	0.	6.7229	-1.2022	1.4772
2088	51	63	0.0135200	0.25882	-0.96593	0.	6.7229	-1.2022	1.3772
2089	52	63	0.0135200	0.25882	-0.96593	0.	6.7229	-1.2022	1.2772
2090	53	63	0.0135200	0.25882	-0.96593	0.	6.7229	-1.2022	1.1772
2091	54	63	0.0135200	0.25882	-0.96593	0.	6.7229	-1.2022	1.0772
2092	55	63	0.0135200	0.25882	-0.96593	0.	6.7229	-1.2022	0.9772
2093	56	63	0.0135200	0.25882	-0.96593	0.	6.7229	-1.2022	0.8772
2094	57	63	0.0121900	0.25882	-0.96593	0.	6.7229	-1.2022	0.7821
2095	58	63	0.0135200	0.08716	-0.99619	0.	6.5093	-1.2399	1.5098
2096	59	63	0.0135200	0.08716	-0.99619	0.	6.5093	-1.2399	1.4998
2097	60	63	0.0135200	0.08716	-0.99619	0.	6.5093	-1.2399	1.3998
2098	61	63	0.0135200	0.08716	-0.99619	0.	6.5093	-1.2399	1.2998
2099	62	63	0.0135200	0.08716	-0.99619	0.	6.5093	-1.2399	1.1998
2100	63	63	0.0135200	0.08716	-0.99619	0.	6.5093	-1.2399	1.0998
2101	64	63	0.0135200	0.08716	-0.99619	0.	6.5093	-1.2399	0.9998
2102	65	63	0.0135200	0.08716	-0.99619	0.	6.5093	-1.2399	0.8998
2103	66	63	0.0152500	0.08716	-0.99619	0.	6.5093	-1.2399	0.7934
2104	67	63	0.0135200	-0.08716	-0.99619	0.	6.2923	-1.2399	1.7027
2105	68	63	0.0135200	-0.08716	-0.99619	0.	6.2923	-1.2399	1.6027
2106	69	63	0.0135200	-0.08716	-0.99619	0.	6.2923	-1.2399	1.5027
2107	70	63	0.0135200	-0.08716	-0.99619	0.	6.2923	-1.2399	1.4027
2108	71	63	0.0135200	-0.08716	-0.99619	0.	6.2923	-1.2399	1.3027
2109	72	63	0.0135200	-0.08716	-0.99619	0.	6.2923	-1.2399	1.2027
2110	73	63	0.0135200	-0.08716	-0.99619	0.	6.2923	-1.2399	1.1027
2111	74	63	0.0135200	-0.08716	-0.99619	0.	6.2923	-1.2399	1.0027
2112	75	63	0.0135200	-0.08716	-0.99619	0.	6.2923	-1.2399	0.9027
2113	76	63	0.0156400	-0.08716	-0.99619	0.	6.2923	-1.2399	0.7948
2114	77	63	0.0135200	-0.25882	-0.96593	0.	6.0787	-1.2022	1.7027
2115	78	63	0.0135200	-0.25882	-0.96593	0.	6.0787	-1.2022	1.6027

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ.METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
2116	79	63	0.0135200	-0.25882	-0.96593	0.	6.0787	-1.2022	1.5027
2117	80	63	0.0135200	-0.25882	-0.96593	0.	6.0787	-1.2022	1.4027
2118	81	63	0.0135200	-0.25882	-0.96593	0.	6.0787	-1.2022	1.3027
2119	82	63	0.0135200	-0.25882	-0.96593	0.	6.0787	-1.2022	1.2027
2120	83	63	0.0135200	-0.25882	-0.96593	0.	6.0787	-1.2022	1.1027
2121	84	63	0.0135200	-0.25882	-0.96593	0.	6.0787	-1.2022	1.0027
2122	85	63	0.0135200	-0.25882	-0.96593	0.	6.0787	-1.2022	0.9027
2123	86	63	0.0156400	-0.25882	-0.96593	0.	6.0787	-1.2022	0.7948
2124	87	63	0.0135200	-0.42262	-0.90631	0.	5.8748	-1.1280	1.7027
2125	88	63	0.0135200	-0.42262	-0.90631	0.	5.8748	-1.1280	1.6027
2126	89	63	0.0135200	-0.42262	-0.90631	0.	5.8748	-1.1280	1.5027
2127	90	63	0.0135200	-0.42262	-0.90631	0.	5.8748	-1.1280	1.4027
2128	91	63	0.0135200	-0.42262	-0.90631	0.	5.8748	-1.1280	1.3027
2129	92	63	0.0135200	-0.42262	-0.90631	0.	5.8748	-1.1280	1.2027
2130	93	63	0.0135200	-0.42262	-0.90631	0.	5.8748	-1.1280	1.1027
2131	94	63	0.0135200	-0.42262	-0.90631	0.	5.8748	-1.1280	1.0027
2132	95	63	0.0135200	-0.42262	-0.90631	0.	5.8748	-1.1280	0.9027
2133	96	63	0.0156400	-0.42262	-0.90631	0.	5.8748	-1.1280	0.7948
2134	97	63	0.0135200	-0.57358	-0.81915	0.	5.6869	-1.0195	1.7027
2135	98	63	0.0135200	-0.57358	-0.81915	0.	5.6869	-1.0195	1.6027
2136	99	63	0.0135200	-0.57358	-0.81915	0.	5.6869	-1.0195	1.5027
2137	100	63	0.0135200	-0.57358	-0.81915	0.	5.6869	-1.0195	1.4027
2138	101	63	0.0135200	-0.57358	-0.81915	0.	5.6869	-1.0195	1.3027
2139	102	63	0.0135200	-0.57358	-0.81915	0.	5.6869	-1.0195	1.2027
2140	103	63	0.0135200	-0.57358	-0.81915	0.	5.6869	-1.0195	1.1027
2141	104	63	0.0135200	-0.57358	-0.81915	0.	5.6869	-1.0195	1.0027
2142	105	63	0.0135200	-0.57358	-0.81915	0.	5.6869	-1.0195	0.9027
2143	106	63	0.0156400	-0.57358	-0.81915	0.	5.6869	-1.0195	0.7948
2144	107	63	0.0135200	-0.70711	-0.70711	0.	5.5207	-0.8801	1.7027
2145	108	63	0.0135200	-0.70711	-0.70711	0.	5.5207	-0.8801	1.6027
2146	109	63	0.0135200	-0.70711	-0.70711	0.	5.5207	-0.8801	1.5027
2147	110	63	0.0135200	-0.70711	-0.70711	0.	5.5207	-0.8801	1.4027
2148	111	63	0.0135200	-0.70711	-0.70711	0.	5.5207	-0.8801	1.3027
2149	112	63	0.0135200	-0.70711	-0.70711	0.	5.5207	-0.8801	1.2027
2150	113	63	0.0135200	-0.70711	-0.70711	0.	5.5207	-0.8801	1.1027
2151	114	63	0.0135200	-0.70711	-0.70711	0.	5.5207	-0.8801	1.0027
2152	115	63	0.0135200	-0.70711	-0.70711	0.	5.5207	-0.8801	0.9027
2153	116	63	0.0156400	-0.70711	-0.70711	0.	5.5207	-0.8801	0.7948
2154	117	63	0.0135200	-0.81915	-0.57358	0.	5.3813	-0.7139	1.7027
2155	118	63	0.0135200	-0.81915	-0.57358	0.	5.3813	-0.7139	1.6027
2156	119	63	0.0135200	-0.81915	-0.57358	0.	5.3813	-0.7139	1.5027
2157	120	63	0.0135200	-0.81915	-0.57358	0.	5.3813	-0.7139	1.4027
2158	121	63	0.0135200	-0.81915	-0.57358	0.	5.3813	-0.7139	1.3027
2159	122	63	0.0135200	-0.81915	-0.57358	0.	5.3813	-0.7139	1.2027
2160	123	63	0.0135200	-0.81915	-0.57358	0.	5.3813	-0.7139	1.1027
2161	124	63	0.0135200	-0.81915	-0.57358	0.	5.3813	-0.7139	1.0027
2162	125	63	0.0135200	-0.81915	-0.57358	0.	5.3813	-0.7139	0.9027



TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
2163	126	63	0.0156400	-0.81915	-0.57358	0.	5.3813	-0.7139	0.7948
2164	127	63	0.0135200	-0.90631	-0.42262	0.	5.2729	-0.5260	1.7027
2165	128	63	0.0135200	-0.90631	-0.42262	0.	5.2729	-0.5260	1.6027
2166	129	63	0.0135200	-0.90631	-0.42262	0.	5.2729	-0.5260	1.5027
2167	130	63	0.0135200	-0.90631	-0.42262	0.	5.2729	-0.5260	1.4027
2168	131	63	0.0135200	-0.90631	-0.42262	0.	5.2729	-0.5260	1.3027
2169	132	63	0.0135200	-0.90631	-0.42262	0.	5.2729	-0.5260	1.2027
2170	133	63	0.0135200	-0.90631	-0.42262	0.	5.2729	-0.5260	1.1027
2171	134	63	0.0135200	-0.90631	-0.42262	0.	5.2729	-0.5260	1.0027
2172	135	63	0.0135200	-0.90631	-0.42262	0.	5.2729	-0.5260	0.9027
2173	136	63	0.0156400	-0.90631	-0.42262	0.	5.2729	-0.5260	0.7948
2174	137	63	0.0135200	-0.96593	-0.25882	0.	5.1986	-0.3221	1.7027
2175	138	63	0.0135200	-0.96593	-0.25882	0.	5.1986	-0.3221	1.6027
2176	139	63	0.0135200	-0.96593	-0.25882	0.	5.1986	-0.3221	1.5027
2177	140	63	0.0135200	-0.96593	-0.25882	0.	5.1986	-0.3221	1.4027
2178	141	63	0.0135200	-0.96593	-0.25882	0.	5.1986	-0.3221	1.3027
2179	142	63	0.0135200	-0.96593	-0.25882	0.	5.1986	-0.3221	1.2027
2180	143	63	0.0135200	-0.96593	-0.25882	0.	5.1986	-0.3221	1.1027
2181	144	63	0.0135200	-0.96593	-0.25882	0.	5.1986	-0.3221	1.0027
2182	145	63	0.0135200	-0.96593	-0.25882	0.	5.1986	-0.3221	0.9027
2183	146	63	0.0156400	-0.96593	-0.25882	0.	5.1986	-0.3221	0.7948
2184	147	63	0.0135200	-0.99619	-0.08716	0.	5.1609	-0.1085	1.7027
2185	148	63	0.0135200	-0.99619	-0.08716	0.	5.1609	-0.1085	1.6027
2186	149	63	0.0135200	-0.99619	-0.08716	0.	5.1609	-0.1085	1.5027
2187	150	63	0.0135200	-0.99619	-0.08716	0.	5.1609	-0.1085	1.4027
2188	151	63	0.0135200	-0.99619	-0.08716	0.	5.1609	-0.1085	1.3027
2189	152	63	0.0135200	-0.99619	-0.08716	0.	5.1609	-0.1085	1.2027
2190	153	63	0.0135200	-0.99619	-0.08716	0.	5.1609	-0.1085	1.1027
2191	154	63	0.0135200	-0.99619	-0.08716	0.	5.1609	-0.1085	1.0027
2192	155	63	0.0135200	-0.99619	-0.08716	0.	5.1609	-0.1085	0.9027
2193	156	63	0.0156400	-0.99619	-0.08716	0.	5.1609	-0.1085	0.7948
2194	157	63	0.0135200	-0.99619	0.08716	0.	5.1609	0.1085	1.7027
2195	158	63	0.0135200	-0.99619	0.08716	0.	5.1609	0.1085	1.6027
2196	159	63	0.0135200	-0.99619	0.08716	0.	5.1609	0.1085	1.5027
2197	160	63	0.0135200	-0.99619	0.08716	0.	5.1609	0.1085	1.4027
2198	161	63	0.0135200	-0.99619	0.08716	0.	5.1609	0.1085	1.3027
2199	162	63	0.0135200	-0.99619	0.08716	0.	5.1609	0.1085	1.2027
2200	163	63	0.0135200	-0.99619	0.08716	0.	5.1609	0.1085	1.1027
2201	164	63	0.0135200	-0.99619	0.08716	0.	5.1609	0.1085	1.0027
2202	165	63	0.0135200	-0.99619	0.08716	0.	5.1609	0.1085	0.9027
2203	166	63	0.0156400	-0.99617	0.08746	0.	5.1609	0.1085	0.7948
2204	167	63	0.0135200	-0.96593	0.25882	0.	5.1986	0.3221	1.7027
2205	168	63	0.0135200	-0.96593	0.25882	0.	5.1986	0.3221	1.6027
2206	169	63	0.0135200	-0.96593	0.25882	0.	5.1986	0.3221	1.5027
2207	170	63	0.0135200	-0.96593	0.25882	0.	5.1986	0.3221	1.4027
2208	171	63	0.0135200	-0.96593	0.25882	0.	5.1986	0.3221	1.3027
2209	172	63	0.0135200	-0.96593	0.25882	0.	5.1986	0.3221	1.2027

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
2210	173	63	0.0135200	-0.96593	0.25882	0.	5.1986	0.3221	1.1027
2211	174	63	0.0135200	-0.96593	0.25882	0.	5.1986	0.3221	1.0027
2212	175	63	0.0135200	-0.96593	0.25882	0.	5.1986	0.3221	0.9027
2213	176	63	0.0156400	-0.96593	0.25882	0.	5.1986	0.3221	0.7948
2214	177	63	0.0135200	-0.90631	0.42262	0.	5.2729	0.5260	1.7027
2215	178	63	0.0135200	-0.90631	0.42262	0.	5.2729	0.5260	1.6027
2216	179	63	0.0135200	-0.90631	0.42262	0.	5.2729	0.5260	1.5027
2217	180	63	0.0135200	-0.90631	0.42262	0.	5.2729	0.5260	1.4027
2218	181	63	0.0135200	-0.90631	0.42262	0.	5.2729	0.5260	1.3027
2219	182	63	0.0135200	-0.90631	0.42262	0.	5.2729	0.5260	1.2027
2220	183	63	0.0135200	-0.90631	0.42262	0.	5.2729	0.5260	1.1027
2221	184	63	0.0135200	-0.90631	0.42262	0.	5.2729	0.5260	1.0027
2222	185	63	0.0135200	-0.90631	0.42262	0.	5.2729	0.5260	0.9027
2223	186	63	0.0156400	-0.90631	0.42262	0.	5.2729	0.5260	0.7948
2224	187	63	0.0135200	-0.81915	0.57358	0.	5.3813	0.7139	1.7027
2225	188	63	0.0135200	-0.81915	0.57358	0.	5.3813	0.7139	1.6027
2226	189	63	0.0135200	-0.81915	0.57358	0.	5.3813	0.7139	1.5027
2227	190	63	0.0135200	-0.81915	0.57358	0.	5.3813	0.7139	1.4027
2228	191	63	0.0135200	-0.81915	0.57358	0.	5.3813	0.7139	1.3027
2229	192	63	0.0135200	-0.81915	0.57358	0.	5.3813	0.7139	1.2027
2230	193	63	0.0135200	-0.81915	0.57358	0.	5.3813	0.7139	1.1027
2231	194	63	0.0135200	-0.81915	0.57358	0.	5.3813	0.7139	1.0027
2232	195	63	0.0135200	-0.81915	0.57358	0.	5.3813	0.7139	0.9027
2233	196	63	0.0156400	-0.81915	0.57358	0.	5.3813	0.7139	0.7948
2234	197	63	0.0135200	-0.70711	0.70711	0.	5.5207	0.8801	1.7027
2235	198	63	0.0135200	-0.70711	0.70711	0.	5.5207	0.8801	1.6027
2236	199	63	0.0135200	-0.70711	0.70711	0.	5.5207	0.8801	1.5027
2237	200	63	0.0135200	-0.70711	0.70711	0.	5.5207	0.8801	1.4027
2238	201	63	0.0135200	-0.70711	0.70711	0.	5.5207	0.8801	1.3027
2239	202	63	0.0135200	-0.70711	0.70711	0.	5.5207	0.8801	1.2027
2240	203	63	0.0135200	-0.70711	0.70711	0.	5.5207	0.8801	1.1027
2241	204	63	0.0135200	-0.70711	0.70711	0.	5.5207	0.8801	1.0027
2242	205	63	0.0135200	-0.70711	0.70711	0.	5.5207	0.8801	0.9027
2243	206	63	0.0156400	-0.70711	0.70711	0.	5.5207	0.8801	0.7948
2244	207	63	0.0135200	-0.57358	0.81915	0.	5.6869	1.0195	1.7027
2245	208	63	0.0135200	-0.57358	0.81915	0.	5.6869	1.0195	1.6027
2246	209	63	0.0135200	-0.57358	0.81915	0.	5.6869	1.0195	1.5027
2247	210	63	0.0135200	-0.57358	0.81915	0.	5.6869	1.0195	1.4027
2248	211	63	0.0135200	-0.57358	0.81915	0.	5.6869	1.0195	1.3027
2249	212	63	0.0135200	-0.57358	0.81915	0.	5.6869	1.0195	1.2027
2250	213	63	0.0135200	-0.57358	0.81915	0.	5.6869	1.0195	1.1027
2251	214	63	0.0135200	-0.57358	0.81915	0.	5.6869	1.0195	1.0027
2252	215	63	0.0135200	-0.57358	0.81915	0.	5.6869	1.0195	0.9027
2253	216	63	0.0156400	-0.57358	0.81915	0.	5.6869	1.0195	0.7948
2254	217	63	0.0135200	-0.42262	0.90631	0.	5.8748	1.1280	1.7027
2255	218	63	0.0135200	-0.42262	0.90631	0.	5.8748	1.1280	1.6027
2256	219	63	0.0135200	-0.42262	0.90631	0.	5.8748	1.1280	1.5027

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
2257	220	63	0.0135200	-0.42262	0.90631	0.	5.8748	1.1280	1.4027
2258	221	63	0.0135200	-0.42262	0.90631	0.	5.8748	1.1280	1.3027
2259	222	63	0.0135200	-0.42262	0.90631	0.	5.8748	1.1280	1.2027
2260	223	63	0.0135200	-0.42262	0.90631	0.	5.8748	1.1280	1.1027
2261	224	63	0.0135200	-0.42262	0.90631	0.	5.8748	1.1280	1.0027
2262	225	63	0.0135200	-0.42262	0.90631	0.	5.8748	1.1280	0.9027
2263	226	63	0.0156400	-0.42262	0.90631	0.	5.8748	1.1280	0.7948
2264	227	63	0.0135200	-0.25882	0.96593	0.	6.0787	1.2022	1.7027
2265	228	63	0.0135200	-0.25882	0.96593	0.	6.0787	1.2022	1.6027
2266	229	63	0.0135200	-0.25882	0.96593	0.	6.0787	1.2022	1.5027
2267	230	63	0.0135200	-0.25882	0.96593	0.	6.0787	1.2022	1.4027
2268	231	63	0.0135200	-0.25882	0.96593	0.	6.0787	1.2022	1.3027
2269	232	63	0.0135200	-0.25882	0.96593	0.	6.0787	1.2022	1.2027
2270	233	63	0.0135200	-0.25882	0.96593	0.	6.0787	1.2022	1.1027
2271	234	63	0.0135200	-0.25882	0.96593	0.	6.0787	1.2022	1.0027
2272	235	63	0.0135200	-0.25882	0.96593	0.	6.0787	1.2022	0.9027
2273	236	63	0.0156400	-0.25882	0.96593	0.	6.0787	1.2022	0.7948
2274	237	63	0.0135200	-0.08716	0.99619	0.	6.2923	1.2399	1.7027
2275	238	63	0.0135200	-0.08716	0.99619	0.	6.2923	1.2399	1.7027
2276	239	63	0.0135200	-0.08716	0.99619	0.	6.2923	1.2399	1.5027
2277	240	63	0.0135200	-0.08716	0.99619	0.	6.2923	1.2399	1.4027
2278	241	63	0.0135200	-0.08716	0.99619	0.	6.2923	1.2399	1.3027
2279	242	63	0.0135200	-0.08716	0.99619	0.	6.2923	1.2399	1.2027
2280	243	63	0.0135200	-0.08716	0.99619	0.	6.2923	1.2399	1.1027
2281	244	63	0.0135200	-0.08716	0.99619	0.	6.2923	1.2399	1.0027
2282	245	63	0.0135200	-0.08716	0.99619	0.	6.2923	1.2399	0.9027
2283	246	63	0.0156400	-0.08716	0.99619	0.	6.2923	1.2399	0.7948
2284	247	63	0.0135200	0.08716	0.99619	0.	6.5093	1.2399	1.5998
2285	248	63	0.0135200	0.08716	0.99619	0.	6.5093	1.2399	1.4998
2286	249	63	0.0135200	0.08716	0.99619	0.	6.5093	1.2399	1.3998
2287	250	63	0.0135200	0.08716	0.99619	0.	6.5093	1.2399	1.2998
2288	251	63	0.0135200	0.08716	0.99619	0.	6.5093	1.2399	1.1998
2289	252	63	0.0135200	0.08716	0.99619	0.	6.5093	1.2399	1.0998
2290	253	63	0.0135200	0.08716	0.99619	0.	6.5093	1.2399	0.9998
2291	254	63	0.0135200	0.08716	0.99619	0.	6.5093	1.2399	0.8998
2292	255	63	0.0152500	0.08716	0.99619	0.	6.5093	1.2399	0.7934
2293	256	63	0.0135200	0.25882	0.96593	0.	6.7229	1.2022	1.4772
2294	257	63	0.0135200	0.25882	0.96593	0.	6.7229	1.2022	1.3772
2295	258	63	0.0135200	0.25882	0.96593	0.	6.7229	1.2022	1.2772
2296	259	63	0.0135200	0.25882	0.96593	0.	6.7229	1.2022	1.1772
2297	260	63	0.0135200	0.25882	0.96593	0.	6.7229	1.2022	1.0772
2298	261	63	0.0135200	0.25882	0.96593	0.	6.7229	1.2022	0.9772
2299	262	63	0.0135200	0.25882	0.96593	0.	6.7229	1.2022	0.8772
2300	263	63	0.0121900	0.25882	0.96593	0.	6.7229	1.2022	0.7821
2301	264	63	0.0135200	0.42262	0.90631	0.	6.9268	1.1280	1.3602
2302	265	63	0.0135200	0.42262	0.90631	0.	6.9268	1.1280	1.2602
2303	266	63	0.0135200	0.42262	0.90631	0.	6.9268	1.1280	1.1602

TABLE II

CUM. ELEM NO.	ELEM NO.	SUR. NO.	AREA SQ. METERS	DIRECTION COSINES			ELEM MIDPOINT IN METERS IF SHADOWABLE VEHICLE COORDINATE SYSTEM		
				I	J	K	X	Y	Z
2304	267	63	0.0135200	0.42262	0.90631	0.	6.9268	1.1280	1.0602
2305	268	63	0.0135200	0.42262	0.90631	0.	6.9268	1.1280	0.9602
2306	269	63	0.0135200	0.42262	0.90631	0.	6.9268	1.1280	0.8602
2307	270	63	0.0099000	0.42262	0.90631	0.	6.9268	1.1280	0.7736
2308	271	63	0.0135200	0.57358	0.81915	0.	7.1147	1.0195	1.2676
2309	272	63	0.0135200	0.57358	0.81915	0.	7.1147	1.0195	1.1676
2310	273	63	0.0135200	0.57358	0.81915	0.	7.1147	1.0195	1.0676
2311	274	63	0.0135200	0.57358	0.81915	0.	7.1147	1.0195	0.9676
2312	275	63	0.0135200	0.57358	0.81915	0.	7.1147	1.0195	0.8676
2313	276	63	0.0109000	0.57358	0.81915	0.	7.1147	1.0195	0.7773
2314	277	63	0.0135200	0.70711	0.70711	0.	7.2809	0.8801	1.4282
2315	278	63	0.0135200	0.70711	0.70711	0.	7.2809	0.8801	1.3282
2316	279	63	0.0135200	0.70711	0.70711	0.	7.2809	0.8801	1.2282
2317	280	63	0.0135200	0.70711	0.70711	0.	7.2809	0.8801	1.1282
2318	281	63	0.0135200	0.70711	0.70711	0.	7.2809	0.8801	1.0282
2319	282	63	0.0135200	0.70711	0.70711	0.	7.2809	0.8801	0.9282
2320	283	63	0.0190900	0.70711	0.70711	0.	7.2809	0.8801	0.8076
2321	284	63	0.0135200	0.81915	0.57358	0.	7.4203	0.7139	1.5609
2322	285	63	0.0135200	0.81915	0.57358	0.	7.4203	0.7139	1.4609
2323	286	63	0.0135200	0.81915	0.57358	0.	7.4203	0.7139	1.3609
2324	287	63	0.0135200	0.81915	0.57358	0.	7.4203	0.7139	1.2609
2325	288	63	0.0135200	0.81915	0.57358	0.	7.4203	0.7139	1.1609
2326	289	63	0.0135200	0.81915	0.57358	0.	7.4203	0.7139	1.0609
2327	290	63	0.0135200	0.81915	0.57358	0.	7.4203	0.7139	0.9609
2328	291	63	0.0135200	0.81915	0.57358	0.	7.4203	0.7139	0.8609
2329	292	63	0.0099900	0.81915	0.57358	0.	7.4203	0.7139	0.7740
2330	293	63	0.0135200	0.90631	0.42262	0.	7.5288	0.5260	1.6677
2331	294	63	0.0135200	0.90631	0.42262	0.	7.5288	0.5260	1.5677
2332	295	63	0.0135200	0.90631	0.42262	0.	7.5288	0.5260	1.4677
2333	296	63	0.0135200	0.90631	0.42262	0.	7.5288	0.5260	1.3677
2334	297	63	0.0135200	0.90631	0.42262	0.	7.5288	0.5260	1.2677
2335	298	63	0.0135200	0.90631	0.42262	0.	7.5288	0.5260	1.1677
2336	299	63	0.0135200	0.90631	0.42262	0.	7.5288	0.5260	1.0677
2337	300	63	0.0135200	0.90631	0.42262	0.	7.5288	0.5260	0.9677
2338	301	63	0.0135200	0.90631	0.42262	0.	7.5288	0.5260	0.8677
2339	302	63	0.0109100	0.90631	0.42262	0.	7.5288	0.5260	0.7774
2340	303	63	0.0066500	0.95341	0.30168	0.	7.5874	0.3755	1.7243
2341	304	63	0.0066500	0.95341	0.30168	0.	7.5874	0.3755	1.6243
2342	305	63	0.0066500	0.95341	0.30168	0.	7.5874	0.3755	1.5243
2343	306	63	0.0066500	0.95341	0.30168	0.	7.5874	0.3755	1.4243
2344	307	63	0.0066500	0.95341	0.30168	0.	7.5874	0.3755	1.3243
2345	308	63	0.0066500	0.95341	0.30168	0.	7.5874	0.3755	1.2243
2346	309	63	0.0066500	0.95341	0.30168	0.	7.5874	0.3755	1.1243
2347	310	63	0.0066500	0.95341	0.30168	0.	7.5874	0.3755	1.0243
2348	311	63	0.0066500	0.95341	0.30168	0.	7.5874	0.3755	0.9243
2349	312	63	0.0091300	0.95341	0.30168	0.	7.5874	0.3755	0.8057

TABLE III

## SHADOWER DESCRIPTION

SHAD. NO.	CORNERS	AREA	DIRECTION COSINES			CORNER COORDINATES		
			I	J	K	X	Y	Z
1	4	0.5663	-0.4379	-0.8990	-0.	6.4516	1.2446	0.7366
						7.0929	0.9322	0.7366
						7.0929	0.9322	1.3081
						6.4516	1.2446	1.7527
2	4	0.7384	0.7659	0.6430	-0.	7.0929	0.9322	0.7366
						7.0929	0.9322	1.3018
						7.6111	0.3150	2.0040
						7.6111	0.3150	0.7366
3	6	0.4548	0.0940	0.9956	-0.	7.6111	0.3150	0.7366
						7.6111	0.3150	2.1890
						7.6962	0.3069	2.1890
						7.7978	0.2973	2.0066
						8.0447	0.2740	1.2254
						7.9375	0.2842	0.7366
						6.4516	-1.2446	0.7366
4	4	0.5663	0.4379	-0.8990	0.	7.0929	-0.9322	0.7366
						7.0929	-0.9322	1.3081
						6.4516	-1.2446	1.7527
						7.0929	-0.9322	0.7366
5	4	0.7409	-0.7659	0.6430	0.	7.0929	-0.9322	1.3081
						7.0929	-0.9322	1.3081
						7.6111	-0.3150	2.0040
						7.6111	-0.3150	0.7366
6	6	0.4548	-0.0940	0.9956	0.	7.6111	-0.3150	0.7366
						7.6111	-0.3150	2.1890
						7.6962	-0.3069	2.1890
						7.7978	-0.2973	2.0066
						8.0447	-0.2740	1.2254
						7.9375	-0.2842	0.7366
						6.4389	-1.3716	0.7366
7	4	2.1542	0.	-1.0000	-0.	6.4389	-1.3716	-0.8636
						6.4389	-1.3716	-0.8636
						7.7851	-1.3716	-0.8636
						7.7851	-1.3716	0.7366
8	4	0.9662	-0.	-0.	1.0000	7.9375	-0.3150	0.7366
						7.6050	-0.3150	0.7366
						6.4400	-1.3710	0.7366
						7.9375	-1.3710	0.7366
9	4	0.3105	0.0959	0.9954	-0.	6.3300	0.4670	1.7527
						5.2984	0.5664	1.7527
						5.2984	0.5664	1.8228
						7.6962	0.3356	2.1890
10	4	0.3105	-0.0959	0.9954	0.	6.3300	-0.4670	1.7527
						5.2984	-0.5664	1.7527
						5.2984	-0.5664	1.8228
						7.6962	-0.3356	2.1890
11	4	0.5971	-0.1928	0.9812	0.	6.4516	1.2446	0.7366
						5.8750	1.1313	0.7366
						5.8750	1.1313	1.7527
						6.4516	1.2446	1.7527

TABLE III

## SHADOWER DESCRIPTION

SHAD. NO.	CORNERS	AREA	DIRECTION COSINES			CORNER COORDINATES		
			I	J	K	X	Y	Z
12	4	0.8202	0.6998	-0.7143	-0.	5.8750	1.1313	0.7366
						5.8750	1.1313	1.7527
						5.2984	0.5664	1.7527
						5.2984	0.5664	0.7366
13	4	0.5971	0.1928	0.9812	-0.	6.4516	-1.2446	0.7366
						5.8750	-1.1313	0.7366
						5.8750	-1.1313	1.7527
						6.4516	-1.2446	1.7527
14	4	0.8202	-0.6998	-0.7143	0.	5.8750	-1.1313	0.7366
						5.8750	-1.1313	1.7527
						5.2984	-0.5664	1.7527
						5.2984	-0.5664	0.7366
15	4	0.9662	0.	-0.	-1.0000	7.9375	0.3150	0.7366
						7.6050	0.3150	0.7366
						6.4400	1.3710	0.7366
						7.9375	1.3710	0.7366
16	4	1.2456	-1.0000	-0.	-0.	6.4389	-1.3716	0.7366
						6.4389	-1.3716	-0.8636
						6.4389	-2.1500	-0.8636
						6.4389	-2.1500	0.7366
17	5	0.8902	0.	0.	1.0000	7.9380	-0.4380	-0.8640
						7.4890	-0.4380	-0.8640
						6.9560	-0.9440	-0.8640
						6.4520	-1.3720	-0.8640
18	4	0.5761	-0.3892	0.9212	-0.	7.9380	-1.3720	-0.8640
						7.0940	-0.9350	-0.8640
						7.0940	-0.9350	-1.8100
						6.5330	-1.1720	-1.8100
19	6	1.8125	-0.	-0.	1.0000	6.5330	-1.1720	-0.8640
						6.3540	-2.2240	-0.8640
						6.4900	-1.8100	-0.8640
						6.4640	-0.9350	-0.8640
20	3	0.2830	-0.7038	0.7104	0.	5.4260	-0.6080	-0.8640
						5.0920	-1.8100	-0.8640
						5.2280	-2.2240	-0.8640
						7.5190	-0.5140	-0.8640
21	4	1.0206	0.4338	0.9010	0.	7.0940	-0.9350	-1.8100
						7.0940	-0.9350	-0.8640
						6.5330	-1.1720	-0.8640
						6.5330	-1.1720	-1.8100
22	4	0.5761	0.3892	0.9212	0.	5.4190	-0.6356	-1.5685
						5.4190	-0.6356	-0.8636
						7.0940	0.9350	-0.8640
						7.0940	0.9350	-1.8100
23	3	0.2830	0.7038	0.7104	-0.	6.5330	1.1720	-1.8100
						6.5330	1.1720	-0.8640
						7.5190	0.5140	-0.8640
						7.0940	0.9350	-1.8100
						7.0940	0.9350	-0.8640

TABLE III

## SHADOWER DESCRIPTION

SHAD. NO.	CORNERS	AREA	DIRECTION COSINES			CORNER COORDINATES		
			I	J	K	X	Y	Z
24	4	1.0206	-0.4338	0.9010	-0.	6.5330	1.1720	-0.8640
						6.5330	1.1720	-1.8100
						5.4190	0.6356	-1.5685
						5.4190	0.6356	-0.8636
25	4	0.8894	1.0000	-0.	-0.	5.4191	0.6309	-0.8636
						5.4191	-0.6309	-0.8636
						5.4191	-0.6309	-1.5685
						5.4191	0.6309	-1.5685
26	4	1.3379	0.5481	0.8364	0.	6.4900	1.3720	0.7370
						6.4900	1.3720	-0.8640
						5.7910	1.8300	-0.8640
						5.7910	1.8300	0.7370
27	4	0.0726	-0.	-0.	-1.0000	5.2984	0.5407	-0.8640
						5.3655	0.5407	-0.8640
						5.3655	-0.5407	-0.8640
						5.2984	-0.5407	-0.8640
28	5	0.5146	-0.	-0.	1.0000	5.7442	0.9441	-0.8640
						6.4516	1.2058	-0.8640
						6.4516	1.3594	-0.8640
						5.9812	1.8039	-0.8640
29	5	0.5081	0.	0.	-1.0000	5.5107	1.8298	-0.8640
						5.7442	0.9441	-0.8640
						5.4191	0.5407	-0.8640
						5.1275	1.3497	-0.8640
30	4	1.5265	-0.9121	-0.	0.4099	5.1275	1.8298	-0.8640
						5.5107	1.8298	-0.8640
						7.0942	0.9548	-1.8098
						7.0942	-0.9548	-1.8098
31	5	0.8902	-0.	0.	-1.0000	7.5194	-0.5194	-0.8636
						7.5194	0.5141	-0.8636
						7.9380	0.4380	-0.8640
						7.4890	0.4380	-0.8640
32	4	0.8064	-0.	-0.	-1.0000	6.9560	0.9440	-0.8640
						6.4520	1.3720	-0.8640
						7.9380	1.3720	-0.8640
						6.4516	1.3716	0.7370
33	6	1.6999	-0.	-0.	-1.0000	5.2984	0.5564	0.7370
						5.0950	1.1910	0.7370
						5.8420	1.8277	0.7370
						6.4390	-1.2440	0.7370
34	4	4.1061	0.	0.	-1.0000	6.4907	-1.8100	0.7370
						6.3140	-2.2730	0.7370
						5.2680	-2.2730	0.7370
						5.0930	-1.8100	0.7370
						5.3200	-0.6170	0.7370
						6.4400	1.3710	0.7366
						7.9375	1.3710	0.7366
						7.9375	-1.3710	0.7366
						6.4400	-1.3710	0.7366

## SECTION 5

### BIDIRECTIONAL REFLECTANCE OF LEM ASSOCIATED MATERIALS

This section contains a listing in Table IV of the bidirectional reflectance of the primary surface coating of the LEM. This coating was supplied to GD/C by NASA/MSC and measurements were made by personnel of the Radiation Properties Section of the Space Science Laboratory of GD/Convair. Originally 6 coatings were to have been measured, but due to difficulties associated with design changes in the LEM surface thermal coatings, these additional coatings were not available. The bidirectional reflectance of materials is discussed in reference 8 and in Section 2.2 of this report. Figure 3 of this report defines the angles associated with bidirectional reflectance. These angles are  $\theta$ ,  $\theta'$ , and  $\phi'$ . The angles marked with the primes refer to the reflected beam and  $\theta$  refers to the entering beam.  $\theta$  and  $\theta'$  are angles measured from the normal to the reflecting surface and  $\phi'$  is measured as an azimuthal angle in the surface from the projection of the entering beam as a line out to the surface. This is possible only when the surface has no preferential directional characteristics in the azimuthal sense, such as striations, brush strokes, grooves etc. It seems to be true of the sample supplied. The TDM makes use of the bidirectional data of Table IV by use of linear table look-up procedures.

The bidirectional data listed here is within the reference frame of the GD/C reflectometer. In collecting the LEM data  $\phi$  was set to  $270^\circ$ .  $\phi$  defines the azimuthal angle of the entering beam from some arbitrary line within the reflecting surface as established by the orientation of the sample relative to the bidirectional reflectometer. The  $\phi'$  data listed below is in the same instrument reference frame. Within the TDM subroutine all  $\phi'$  data has been translated to a reference frame based on  $\phi$ , so that  $270^\circ$  are subtracted from the  $\phi'$  data below in the data compiled within the TDM subroutine. This LEM reflectivity data, together with LEM geometric data, is introduced into computer memory from a magnetic tape, which is created by auxiliary program 3960A.



BI DIRECTIONAL DATA  
 THETA= 0.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
.0	270.00	1.9363
0.	280.08	1.9363
0.	300.24	1.9363
0.	320.04	1.9363
0.	339.84	1.9363
0.	0.0	1.9363
0.	20.16	1.9363
0.	39.96	1.9363
0.	60.12	1.9363
0.	70.20	1.9363
0.	80.28	1.9363
0.	90.00	1.9363
15.0	270.00	1.3386
15.0	280.08	1.3386
15.0	300.24	1.3386
15.0	320.04	1.3386
15.0	339.84	1.3386
15.0	0.	1.3386
15.0	20.16	1.3386
15.0	39.96	1.3386
15.0	60.12	1.3386
15.0	70.20	1.3386
15.0	80.28	1.3386
15.0	90.00	1.3386
25.0	270.00	0.9538
25.0	280.08	0.9538
25.0	300.24	0.9538
25.0	320.04	0.9538
25.0	339.84	0.9538
25.0	0.	0.9538
25.0	20.16	0.9538
25.0	39.96	0.9538
25.0	60.12	.9538
25.0	70.20	0.9538
25.0	80.28	0.9538
25.0	90.00	0.9538
35.0	270.00	0.6406
35.0	280.08	0.6406
35.0	300.24	0.6406
35.0	320.04	0.6406
35.0	339.84	0.6406
35.0	0.0	0.6406
35.0	20.16	0.6406
35.0	39.96	0.6406
35.0	60.12	0.6406
35.0	70.20	0.6406
35.0	80.28	0.6406
35.0	90.00	0.6406

BI DIRECTIONAL DATA  
 THETA= 0.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
45.0	270.00	0.4330
45.0	280.08	0.4330
45.0	300.24	0.4330
45.0	320.04	0.4330
45.0	339.84	0.4330
45.0	0.0	0.4330
45.0	20.16	0.4330
45.0	39.96	0.4330
45.0	60.12	0.4330
45.0	70.20	0.4330
45.0	80.28	0.4330
45.0	90.00	0.4330
55.0	270.00	0.3096
55.0	280.08	0.3096
55.0	300.24	0.3096
55.0	320.04	0.3096
55.0	339.84	0.3096
55.0	0.0	0.3096
55.0	20.16	0.3096
55.0	39.96	0.3096
55.0	60.12	0.3096
55.0	70.20	0.3096
55.0	80.28	0.3096
55.0	90.00	0.3096
65.0	270.00	0.2407
65.0	280.08	0.2407
65.0	300.24	0.2407
65.0	320.04	0.2407
65.0	339.84	0.2407
65.0	0.0	0.2407
65.0	20.16	0.2407
65.0	39.96	0.2407
65.0	60.12	0.2407
65.0	70.20	0.2407
65.0	80.28	0.2407
65.0	90.00	0.2407
75.0	270.00	.1718
75.0	280.08	.1718
75.0	300.24	.1718
75.0	320.04	.1718
75.0	339.84	.1718
75.0	0.0	.1718
75.0	20.16	.1718
75.0	39.96	.1718
75.0	60.12	.1718
75.0	70.20	.1718
75.0	80.28	.1718
75.0	90.00	.1718

BI DIRECTIONAL DATA  
 THETA= 5.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
.0	270.00	1.8954
0.	280.08	1.8954
0.	300.24	1.8954
0.	320.04	1.8954
0.	339.84	1.8954
0.	0.0	1.8954
0.	20.16	1.8954
0.	39.96	1.8954
0.	60.12	1.8954
0.	70.20	1.8954
0.	80.28	1.8954
0.	90.00	1.8954
15.0	270.00	1.0914
15.0	280.08	1.0973
15.0	300.24	1.1192
15.0	320.04	1.1606
15.0	339.84	1.2195
15.0	0.0	1.2979
15.0	20.16	1.3852
15.0	39.96	1.4739
15.0	60.12	1.5393
15.0	70.20	1.5576
15.0	80.28	1.5758
15.0	90.00	1.5774
25.0	270.00	0.7266
25.0	280.08	0.7289
25.0	300.24	0.7436
25.0	320.04	0.7830
25.0	339.84	.8366
25.0	0.	0.9129
25.0	20.16	1.0109
25.0	39.96	1.1043
25.0	60.12	1.1823
25.0	70.20	1.2074
25.0	80.28	1.2249
25.0	90.00	1.2325
35.0	270.00	0.4789
35.0	280.08	0.4776
35.0	300.24	.4897
35.0	320.04	.5177
35.0	339.84	.5589
35.0	0.	0.6145
35.0	20.16	.6838
35.0	39.96	.7541
35.0	60.12	.8215
35.0	70.20	0.8385
35.0	80.28	0.8581
35.0	90.00	0.8636

BI DIRECTIONAL DATA  
 THETA= 5.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
45.0	270.00	0.3248
45.0	280.08	0.3241
45.0	300.24	0.3316
45.0	320.04	.3482
45.0	339.84	0.3751
45.0	0.	0.4171
45.0	20.16	.4665
45.0	39.96	.5216
45.0	60.12	.5604
45.0	70.20	0.5796
45.0	80.28	.5945
45.0	90.00	0.5927
55.0	270.00	0.2344
55.0	280.08	0.2358
55.0	300.24	0.2415
55.0	320.04	0.2522
55.0	339.84	.2715
55.0	0.	0.2988
55.0	20.16	.3351
55.0	39.96	.3684
55.0	60.12	.4011
55.0	70.20	.4119
55.0	80.28	0.4169
55.0	90.00	0.4188
65.0	270.00	0.1925
65.0	280.08	0.1894
65.0	300.24	0.1928
65.0	320.04	0.2010
65.0	339.84	0.2120
65.0	0.	0.2322
65.0	20.16	.2575
65.0	39.96	.2840
65.0	60.12	0.3066
65.0	70.20	.3148
65.0	80.28	.3181
65.0	90.00	0.3185
75.0	270.00	.1506
75.0	280.08	.1473
75.0	300.24	.1441
75.0	320.04	.1407
75.0	339.84	.1374
75.0	0.0	.1656
75.0	20.16	.1807
75.0	39.96	.1958
75.0	60.12	.2109
75.0	70.20	.2133
75.0	80.28	.2157
75.0	90.00	.2182

BI DIRECTIONAL DATA  
 THETA= 15.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
0.	270.00	1.3346
0.	280.08	1.3346
0.	300.24	1.3346
0.	320.04	1.3346
0.	339.84	1.3346
0.	0.0	1.3346
0.	20.16	1.3346
0.	39.96	1.3346
0.	60.12	1.3346
0.	70.20	1.3346
0.	80.28	1.3346
0.	90.00	1.3346
15.0	270.00	0.6000
15.0	280.08	.6200
15.0	300.24	0.6956
15.0	320.04	0.8157
15.0	339.84	0.9434
15.0	0.	1.0831
15.0	20.16	1.2753
15.0	39.96	1.4835
15.0	60.12	1.6779
15.0	70.20	1.7356
15.0	80.28	1.7950
15.0	90.00	1.8156
25.0	270.00	0.4943
25.0	280.08	.4962
25.0	300.24	0.5184
25.0	320.04	.5640
25.0	339.84	.6525
25.0	0.0	.7923
25.0	20.16	0.9933
25.0	39.96	1.2535
25.0	60.12	1.5126
25.0	70.20	1.6318
25.0	80.28	1.6977
25.0	90.00	1.7244
35.0	270.00	0.3258
35.0	280.08	0.3246
35.0	300.24	0.3374
35.0	320.04	0.3759
35.0	339.84	0.4369
35.0	0.	0.5476
35.0	20.16	.7153
35.0	39.96	0.9306
35.0	60.12	1.1816
35.0	70.20	1.2922
35.0	80.28	1.3579
35.0	90.00	1.3883

BI DIRECTIONAL DATA  
 THETA= 15.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
45.0	270.00	0.2284
45.0	280.08	.2264
45.0	300.24	0.2362
45.0	320.04	.2601
45.0	339.84	0.3034
45.0	0.	0.3796
45.0	20.16	0.5002
45.0	39.96	0.6607
45.0	60.12	0.8598
45.0	70.20	0.9414
45.0	80.28	.9886
45.0	90.00	1.0192
55.0	270.00	0.1719
55.0	280.08	0.1713
55.0	300.24	.1798
55.0	320.04	.1968
55.0	339.84	.2276
55.0	0.	0.2796
55.0	20.16	.3633
55.0	39.96	0.4780
55.0	60.12	.6166
55.0	70.20	.6754
55.0	80.28	.7175
55.0	90.00	0.7278
65.0	270.00	0.1478
65.0	280.08	0.1443
65.0	300.24	.1494
65.0	320.04	.1615
65.0	339.84	0.1837
65.0	0.0	.2216
65.0	20.16	0.2798
65.0	39.96	.3655
65.0	60.12	0.4637
65.0	70.20	.5064
65.0	80.28	0.5337
65.0	90.00	0.5424
75.0	270.00	.1237
75.0	280.08	.1214
75.0	300.24	.1191
75.0	320.04	.1168
75.0	339.84	.1145
75.0	0.0	.1650
75.0	20.16	.2128
75.0	39.96	.2606
75.0	60.12	.3083
75.0	70.20	.3280
75.0	80.28	.3477
75.0	90.00	.3673

BI DIRECTIONAL DATA  
 THETA= 25.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
.0	270.00	1.0007
0.0	280.08	1.0007
0.0	300.24	1.0007
0.0	320.04	1.0007
0.0	339.84	1.0007
0.0	0.0	1.0007
0.0	20.16	1.0007
0.0	39.96	1.0007
0.0	60.12	1.0007
0.0	70.20	1.0007
0.0	80.28	1.0007
0.0	90.00	1.0007
15.0	270.00	0.4943
15.0	280.08	.4962
15.0	300.24	0.5184
15.0	320.04	0.5508
15.0	339.84	0.6671
15.0	0.	0.8080
15.0	20.16	1.0079
15.0	39.96	1.2454
15.0	60.12	1.4940
15.0	70.20	1.5942
15.0	80.28	1.6664
15.0	90.00	1.6988
25.0	270.00	0.3650
25.0	280.08	.3650
25.0	300.24	0.3800
25.0	320.04	0.4100
25.0	339.84	0.4734
25.0	0.	0.6109
25.0	20.16	.8369
25.0	39.96	1.1747
25.0	60.12	1.6287
25.0	70.20	1.8416
25.0	80.28	1.9826
25.0	90.00	2.0335
35.0	270.00	0.2444
35.0	280.08	0.2372
35.0	300.24	0.2450
35.0	320.04	0.2748
35.0	339.84	.3307
35.0	0.	0.4402
35.0	20.16	0.6441
35.0	39.96	0.9767
35.0	60.12	1.4863
35.0	70.20	1.7400
35.0	80.28	1.9328
35.0	90.00	2.0007

BI DIRECTIONAL DATA  
 THETA= 25.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
45.0	270.00	0.1805
45.0	280.08	0.1746
45.0	300.24	0.1813
45.0	320.04	.1999
45.0	339.84	0.2415
45.0	0.0	.3205
45.0	20.16	0.4734
45.0	39.96	.7434
45.0	60.12	1.1848
45.0	70.20	1.4300
45.0	80.28	1.6025
45.0	90.00	1.6777
55.0	270.00	0.1366
55.0	280.08	.1368
55.0	300.24	.1413
55.0	320.04	0.1560
55.0	339.84	.1839
55.0	0.0	.2395
55.0	20.16	.3475
55.0	39.96	0.5519
55.0	60.12	.8863
55.0	70.20	1.0676
55.0	80.28	1.2140
55.0	90.00	1.2684
65.0	270.00	0.1213
65.0	280.08	0.1210
65.0	300.24	.1235
65.0	320.04	.1341
65.0	339.84	0.1558
65.0	0.	0.1998
65.0	20.16	0.2836
65.0	39.96	.4397
65.0	39.96	.4397
65.0	60.12	.6918
65.0	70.20	.8323
65.0	80.28	0.9513
65.0	90.00	0.9839
75.0	270.00	.1060
75.0	280.08	.1058
75.0	300.24	.1056
75.0	320.04	.1054
75.0	339.84	.1052
75.0	0.0	.1591
75.0	20.16	.2759
75.0	39.96	.3927
75.0	60.12	.5094
75.0	70.20	.5727
75.0	80.28	.6360
75.0	90.00	.6994



BI DIRECTIONAL DATA  
 THETA= 35.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
0.	270.00	0.6533
0.0	280.08	.6533
0.0	300.24	.6533
0.0	320.04	.6533
0.0	339.84	.6533
0.0	0.0	.6533
0.0	20.16	.6533
0.0	39.96	.6533
0.0	60.12	.6533
0.0	70.20	.6533
0.0	80.28	.6533
0.	90.00	0.6533
15.0	270.00	0.3295
15.0	280.08	.3300
15.0	300.24	.3531
15.0	320.04	.3866
15.0	339.84	.4400
15.0	0.	0.5621
15.0	20.16	0.7115
15.0	39.96	0.9023
15.0	60.12	1.1189
15.0	70.20	1.2111
15.0	80.28	1.2732
15.0	90.00	1.2961
25.0	270.00	0.1902
25.0	280.08	.2100
25.0	300.24	.2470
25.0	320.04	.2800
25.0	339.84	0.3327
25.0	0.	0.4374
25.0	20.16	0.6308
25.0	39.96	0.9392
25.0	60.12	1.3971
25.0	70.20	1.6311
25.0	80.28	1.8073
25.0	90.00	1.8652
35.0	270.00	0.1693
35.0	280.08	0.1693
35.0	300.24	0.1892
35.0	320.04	.2042
35.0	339.84	.2454
35.0	0.	0.3337
35.0	20.16	0.5095
35.0	39.96	0.8614
35.0	60.12	1.4788
35.0	70.20	1.8728
35.0	80.28	2.1968
35.0	90.00	2.3182

BI DIRECTIONAL DATA  
 THETA= 35.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
45.0	270.00	0.1482
45.0	280.08	0.1450
45.0	300.24	.1458
45.0	320.04	.1578
45.0	339.84	0.1870
45.0	0.	0.2526
45.0	20.16	0.3933
45.0	39.96	0.6976
45.0	60.12	1.3307
45.0	70.20	1.7866
45.0	80.28	2.1944
45.0	90.00	2.3570
55.0	270.00	0.1283
55.0	280.08	0.1240
55.0	300.24	0.1240
55.0	320.04	0.1321
55.0	339.84	0.1547
55.0	0.	0.2031
55.0	20.16	0.3096
55.0	39.96	0.5500
55.0	60.12	1.0999
55.0	70.20	1.4954
55.0	80.28	1.8637
55.0	90.00	2.0340
65.0	270.00	0.1166
65.0	280.08	0.1130
65.0	300.24	0.1133
65.0	320.04	.1191
65.0	339.84	0.1364
65.0	0.	0.1742
65.0	20.16	0.2558
65.0	39.96	0.4456
65.0	60.12	0.8764
65.0	70.20	1.2166
65.0	80.28	1.5353
65.0	90.00	1.6672
75.0	270.00	.1049
75.0	280.08	.1038
75.0	300.24	.1026
75.0	320.04	.1015
75.0	339.84	.1003
75.0	0.0	.1453
75.0	20.16	.3145
75.0	39.96	.4837
75.0	60.12	.6529
75.0	70.20	.8687
75.0	80.28	1.0845
75.0	90.00	1.3004

BI DIRECTIONAL DATA  
 THETA= 45.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
0.	270.00	0.4503
0.0	280.08	.4503
0.0	300.24	.4503
0.0	320.04	.4503
0.0	339.84	.4503
0.0	0.0	.4503
0.0	20.16	.4503
0.0	39.96	.4503
0.0	60.12	.4503
0.0	70.20	.4503
0.0	80.28	.4503
0.	90.00	0.4503
15.0	270.00	0.2376
15.0	280.08	.2400
15.0	300.24	0.2514
15.0	320.04	0.2736
15.0	339.84	.3150
15.0	0.	0.3919
15.0	20.16	0.4993
15.0	39.96	0.6490
15.0	60.12	0.8085
15.0	70.20	0.8805
15.0	80.28	0.9219
15.0	90.00	0.9370
25.0	270.00	0.1855
25.0	280.08	.1857
25.0	300.24	0.1860
25.0	320.04	.2050
25.0	339.84	.2450
25.0	0.	0.3227
25.0	20.16	0.4642
25.0	39.96	0.7158
25.0	60.12	1.0934
25.0	70.20	1.3037
25.0	80.28	1.4634
25.0	90.00	1.5163
35.0	270.00	0.1925
35.0	280.08	.1600
35.0	300.24	.1450
35.0	320.04	.1500
35.0	339.84	0.1890
35.0	0.	0.2557
35.0	20.16	0.3962
35.0	39.96	0.6903
35.0	60.12	1.3039
35.0	70.20	1.7342
35.0	80.28	2.1050
35.0	90.00	2.2419

BI DIRECTIONAL DATA  
 THETA= 45.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
45.0	270.00	0.1508
45.0	280.08	.1500
45.0	300.24	.1450
45.0	320.04	0.1389
45.0	339.84	0.1596
45.0	0.	0.2109
45.0	20.16	0.3285
45.0	39.96	0.6048
45.0	60.12	1.3239
45.0	70.20	1.9375
45.0	80.28	2.6053
45.0	90.00	2.8843
55.0	270.00	0.1441
55.0	280.08	0.1294
55.0	300.24	0.1220
55.0	320.04	.1258
55.0	339.84	0.1404
55.0	0.	0.1767
55.0	20.16	0.2704
55.0	39.96	0.5061
55.0	60.12	1.1921
55.0	70.20	1.8515
55.0	80.28	2.6666
55.0	90.00	3.0867
65.0	270.00	0.1148
65.0	280.08	0.1136
65.0	300.24	0.1120
65.0	320.04	.1125
65.0	339.84	0.1271
65.0	0.	0.1565
65.0	20.16	0.2320
65.0	39.96	0.4187
65.0	60.12	1.0110
65.0	70.20	1.6262
65.0	80.28	2.4247
65.0	90.00	2.8466
75.0	270.00	0.1364
75.0	280.08	0.1265
75.0	300.24	0.1232
75.0	320.04	.1212
75.0	339.84	0.1280
75.0	0.	0.1527
75.0	20.16	0.2128
75.0	39.96	0.3663
75.0	60.48	0.8658
75.0	70.20	1.3877
75.0	80.28	2.1238
75.0	90.00	2.5224

BI DIRECTIONAL DATA  
 THETA= 55.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
0.	270.00	0.3356
0.0	280.08	.3356
0.0	300.24	.3356
0.0	320.04	.3356
0.0	339.84	.3356
0.0	0.0	.3356
0.0	20.16	.3356
0.0	39.96	.3356
0.0	60.12	.3356
0.0	70.20	.3356
0.0	80.28	.3356
0.	90.00	0.3356
15.0	270.00	0.1837
15.0	280.08	0.1853
15.0	300.24	0.1946
15.0	320.04	0.2136
15.0	339.84	.2450
15.0	0.	0.3015
15.0	20.16	.3820
15.0	39.96	.4864
15.0	60.12	0.6010
15.0	70.20	.6485
15.0	80.28	0.6826
15.0	90.00	0.6950
25.0	270.00	0.1503
25.0	280.08	.1508
25.0	300.24	0.1518
25.0	320.04	.1600
25.0	339.84	.2000
25.0	0.	0.2590
25.0	20.16	0.3726
25.0	39.96	.5827
25.0	60.12	.8530
25.0	70.20	1.0741
25.0	80.28	1.2192
25.0	90.00	1.2684
35.0	270.00	0.1519
35.0	280.08	.1500
35.0	300.24	.1299
35.0	320.04	.1350
35.0	339.84	.1550
35.0	0.	0.2129
35.0	20.16	0.3287
35.0	39.96	0.5727
35.0	60.12	1.1032
35.0	70.20	1.4613
35.0	80.28	1.7916
35.0	90.00	1.9093

BI DIRECTIONAL DATA  
 THETA= 55.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
45.0	270.00	0.1699
45.0	280.08	.1450
45.0	300.24	.1150
45.0	320.04	.1150
45.0	339.84	0.1400
45.0	0.0	.1824
45.0	20.16	0.2806
45.0	39.96	.5333
45.0	60.12	1.2176
45.0	70.20	1.8424
45.0	80.28	2.5799
45.0	90.00	2.8744
55.0	270.00	0.0960
55.0	280.08	.0960
55.0	300.24	.0990
55.0	320.04	0.1193
55.0	339.84	0.1294
55.0	0.	0.1612
55.0	20.16	0.2423
55.0	39.96	0.4569
55.0	60.12	1.1503
55.0	70.20	2.1200
55.0	80.28	3.1599
55.0	90.00	3.7984
65.0	270.00	0.1523
65.0	280.08	0.1441
65.0	300.24	0.1295
65.0	320.04	0.1228
65.0	339.84	0.1270
65.0	0.	0.1497
65.0	20.16	0.2139
65.0	39.96	0.3943
65.0	60.12	1.0031
65.0	70.20	1.8015
65.0	80.28	3.2578
65.0	90.00	4.2806
75.0	270.00	0.1822
75.0	280.08	0.1687
75.0	300.24	.1546
75.0	320.04	.1433
75.0	339.84	.1434
75.0	0.	0.1744
75.0	20.16	0.2119
75.0	39.96	.3514
75.0	60.12	0.8337
75.0	70.20	1.5232
75.0	80.28	2.9828
75.0	90.00	4.3085

BI DIRECTIONAL DATA  
 THETA= 65.0 PHI= 270.0

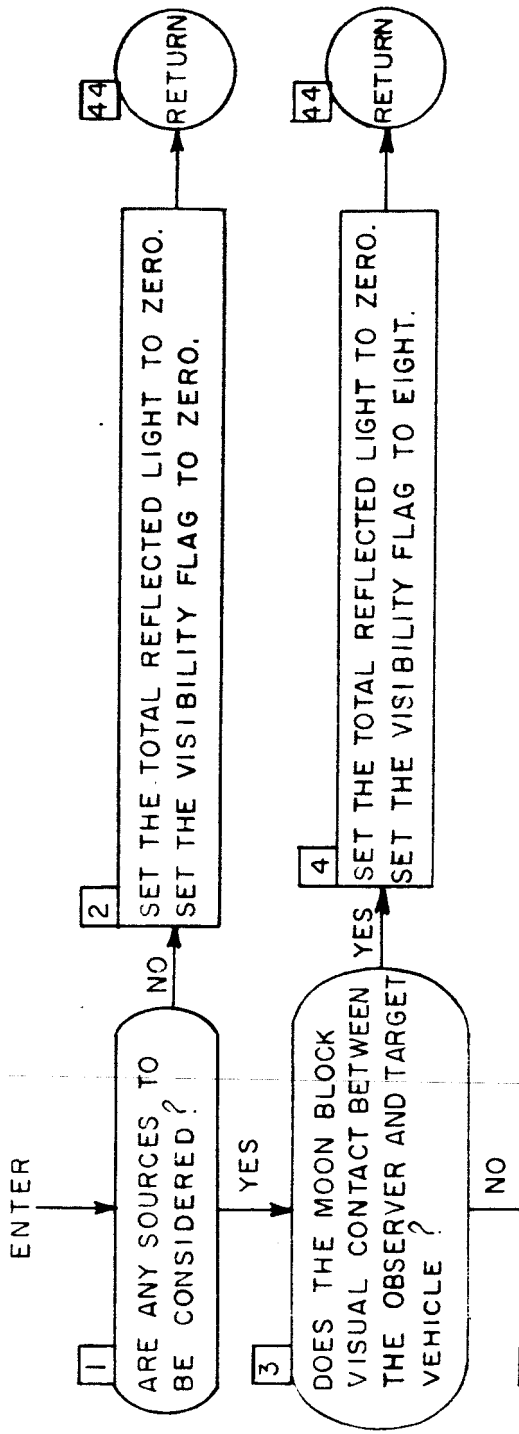
THETA PRIME	PHI PRIME	BI DIR. FUNCTION
0.	270.00	0.2558
0.0	280.08	.2558
0.0	300.24	.2558
0.0	320.04	.2558
0.0	339.84	.2558
0.0	0.0	.2558
0.0	20.16	.2558
0.0	39.96	.2558
0.0	60.12	.2558
0.0	70.20	.2558
0.0	80.28	.2558
0.	90.00	0.2558
15.0	270.00	0.1539
15.0	280.08	0.1539
15.0	300.24	0.1582
15.0	320.04	0.1701
15.0	339.84	0.1929
15.0	0.0	.2200
15.0	20.16	.2843
15.0	39.96	0.3571
15.0	60.12	.4432
15.0	70.20	0.4792
15.0	80.28	0.5057
15.0	90.00	0.5168
25.0	270.00	0.1300
25.0	280.08	0.1271
25.0	300.24	0.1301
25.0	320.04	.1406
25.0	339.84	.1650
25.0	0.	0.2009
25.0	20.16	0.2805
25.0	39.96	0.4135
25.0	60.12	0.6245
25.0	70.20	0.7464
25.0	80.28	0.8360
25.0	90.00	0.8739
35.0	270.00	0.1166
35.0	280.08	.1159
35.0	300.24	0.1148
35.0	320.04	0.1212
35.0	339.84	.1350
35.0	0.	0.1745
35.0	20.16	.2553
35.0	39.96	.4311
35.0	60.12	0.6190
35.0	70.20	1.1214
35.0	80.28	1.3913
35.0	90.00	1.5145

BI DIRECTIONAL DATA  
 THETA= 65.0 PHI= 270.0

THETA PRIME	PHI PRIME	BI DIR. FUNCTION
45.0	270.00	0.1374
45.0	280.08	.1310
45.0	300.24	0.1182
45.0	320.04	.1150
45.0	339.84	.1250
45.0	0.	0.1585
45.0	20.16	0.2287
45.0	39.96	0.4136
45.0	60.12	.9593
45.0	70.20	1.5156
45.0	80.28	2.2247
45.0	90.00	2.6199
55.0	270.00	0.1531
55.0	280.08	.1400
55.0	300.24	.1150
55.0	320.04	.1100
55.0	339.84	0.1286
55.0	0.	0.1490
55.0	20.16	0.2073
55.0	39.96	0.3727
55.0	60.12	0.9504
55.0	70.20	1.7476
55.0	80.28	3.2435
55.0	90.00	4.3207
65.0	270.00	0.1328
65.0	280.08	.1328
65.0	300.24	0.1328
65.0	320.40	0.1327
65.0	339.84	0.1362
65.0	0.	0.1507
65.0	20.16	0.1990
65.0	39.96	0.3400
65.0	60.12	0.8761
65.0	70.20	1.7286
65.0	80.28	4.1117
65.0	90.00	6.7912
75.0	270.00	0.2275
75.0	280.08	0.2174
75.0	300.24	0.1914
75.0	320.04	0.1756
75.0	339.84	0.1654
75.0	0.	0.1677
75.0	20.16	0.2028
75.0	39.96	0.3140
75.0	60.12	0.7516
75.0	70.20	1.4990
75.0	80.28	4.2426
75.0	90.00	9.7051
75.0	90.00	9.7054

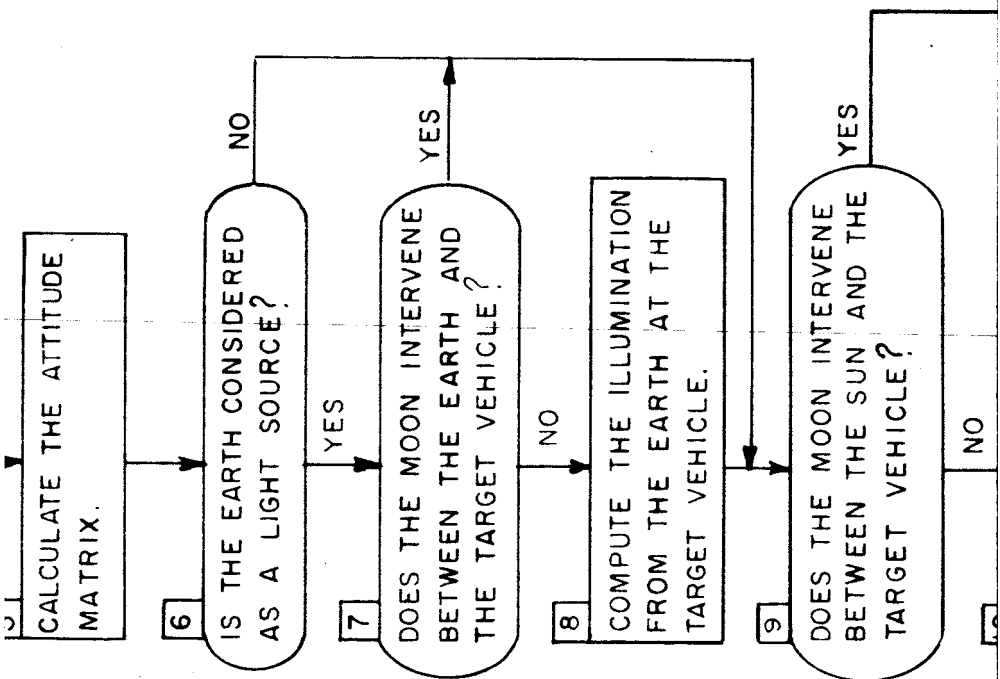


# SUBROUTINE TDM



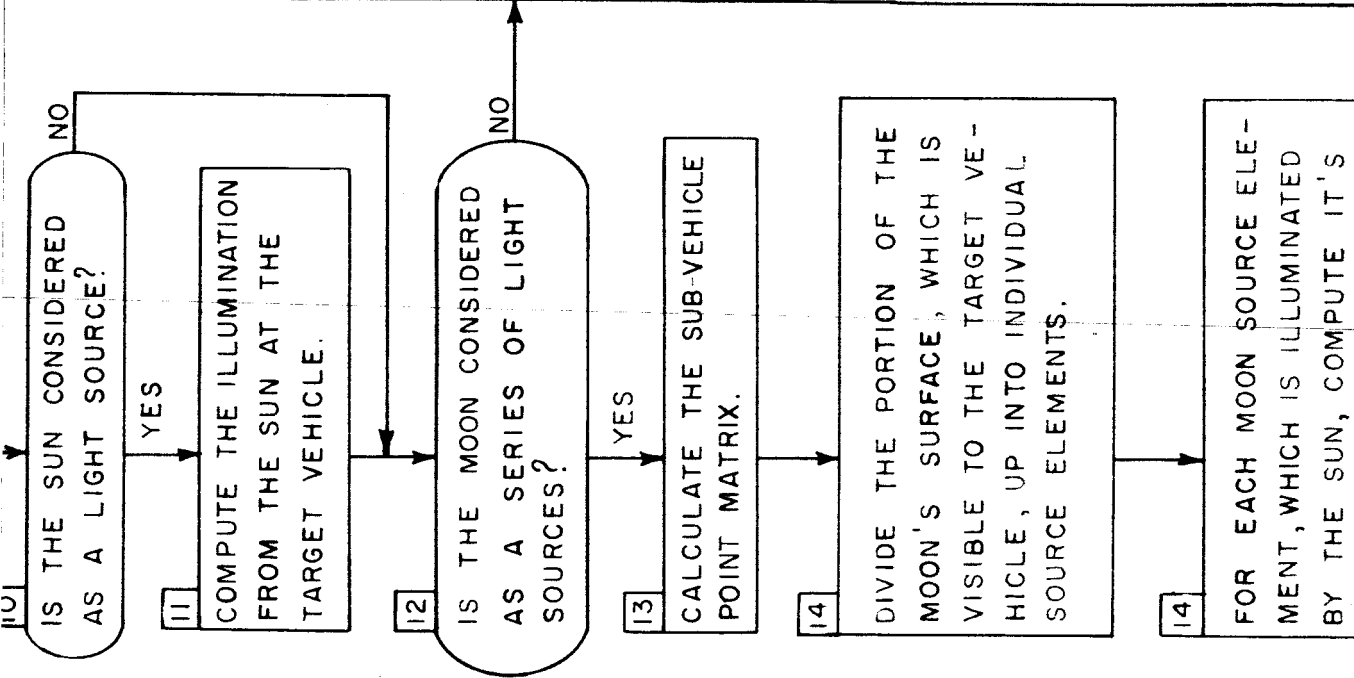
6.1 Flowchart

37①

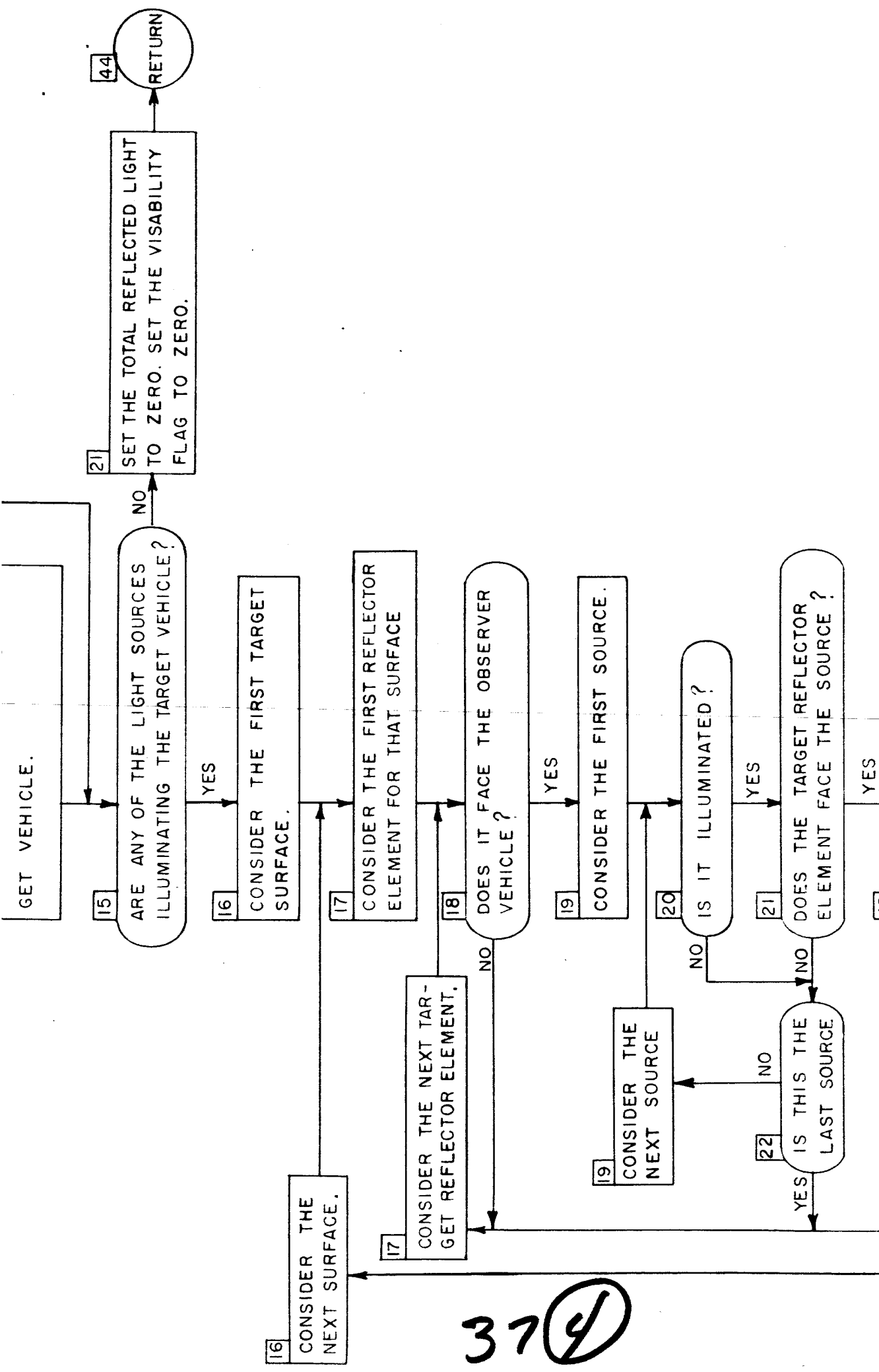


W CHART

37(2)



37 (3)



37 (4)

37 (5)

RECORD THE FIRST SOURCE WHICH IS ILLUMINATED AND WHICH THE TARGET REFLECTOR ELEMENT FACES.

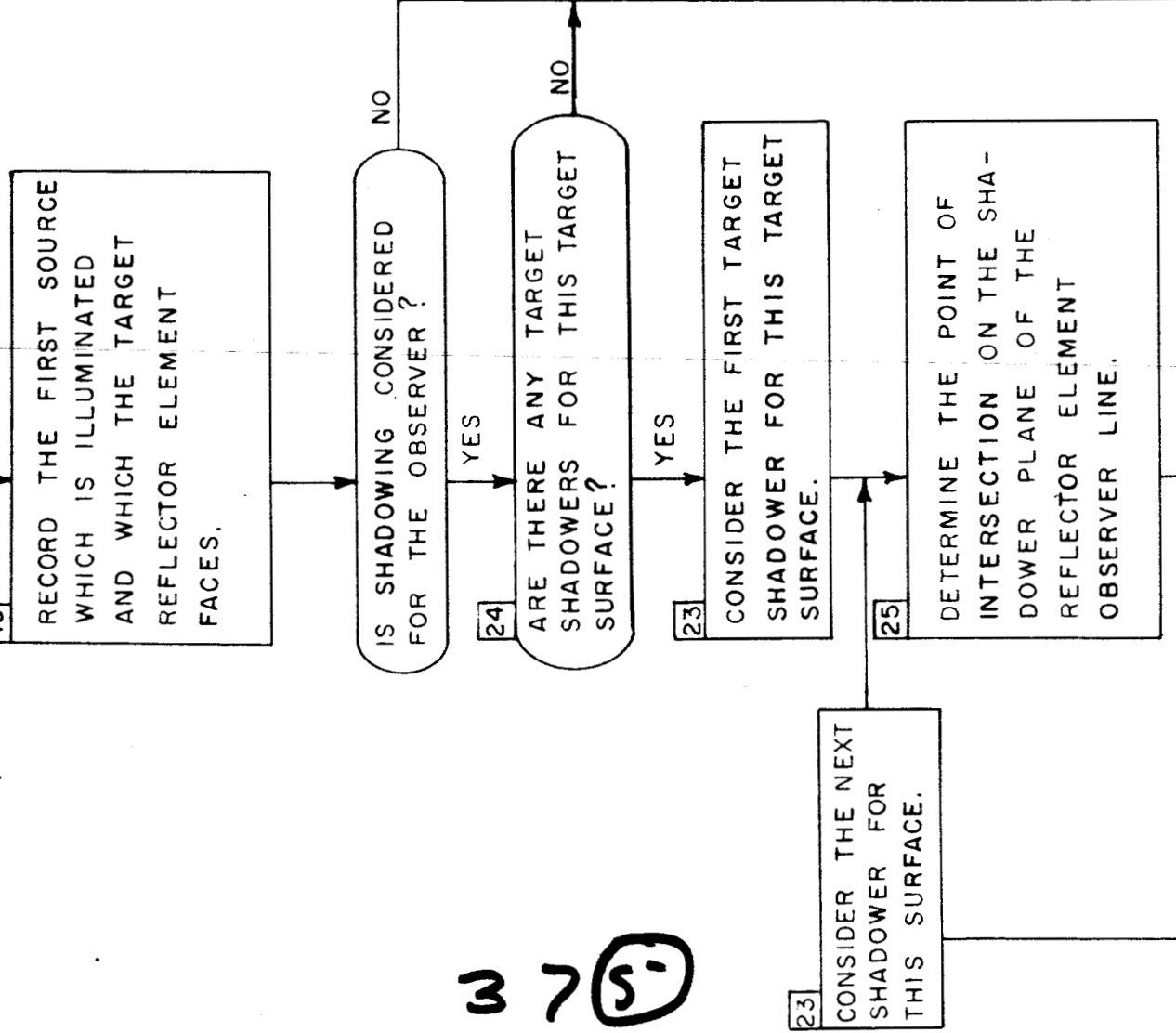
IS SHADOWING CONSIDERED FOR THE OBSERVER?

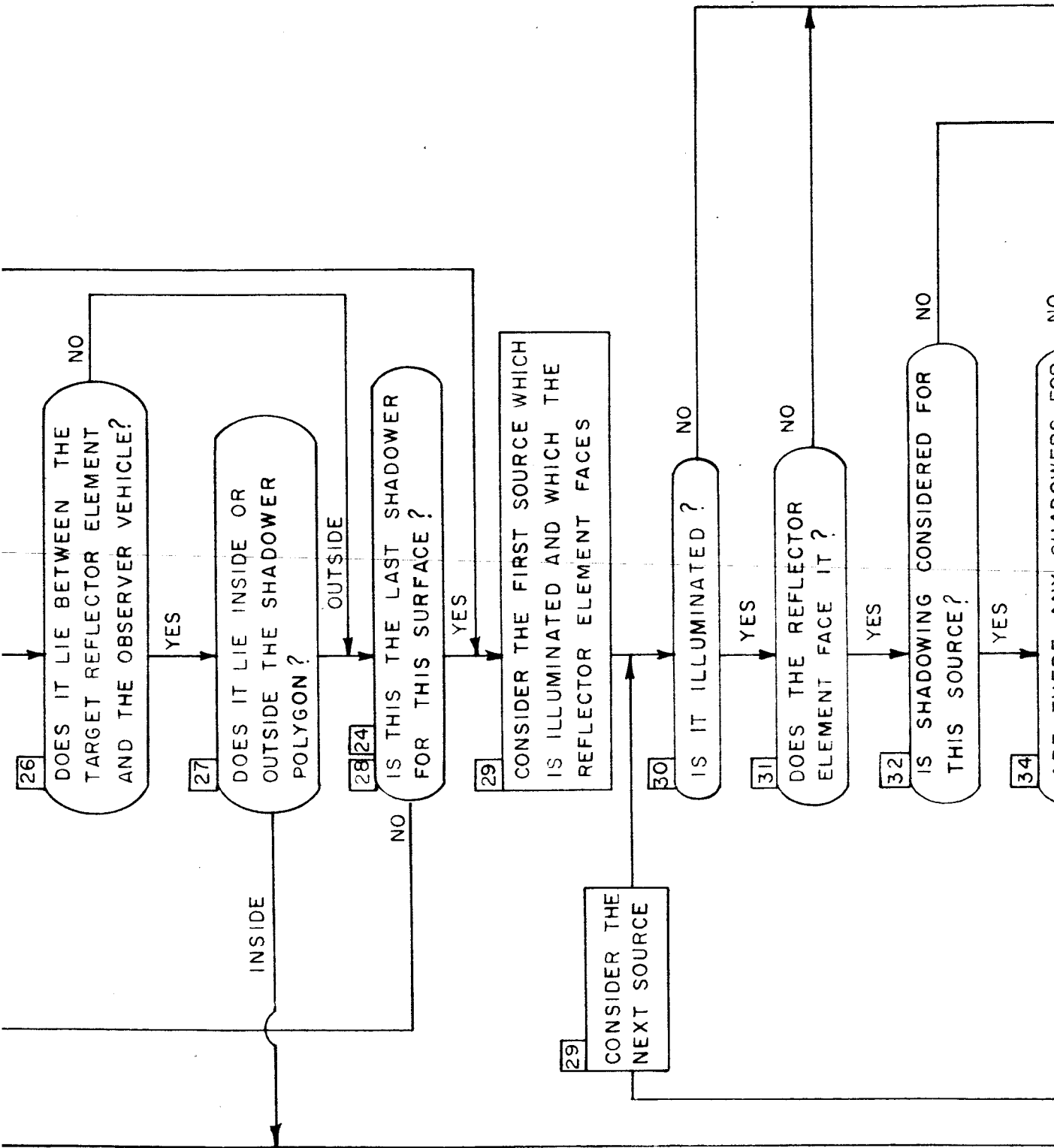
ARE THERE ANY TARGET SHADOWS FOR THIS TARGET SURFACE?

CONSIDER THE FIRST TARGET SHADOW FOR THIS TARGET SURFACE.

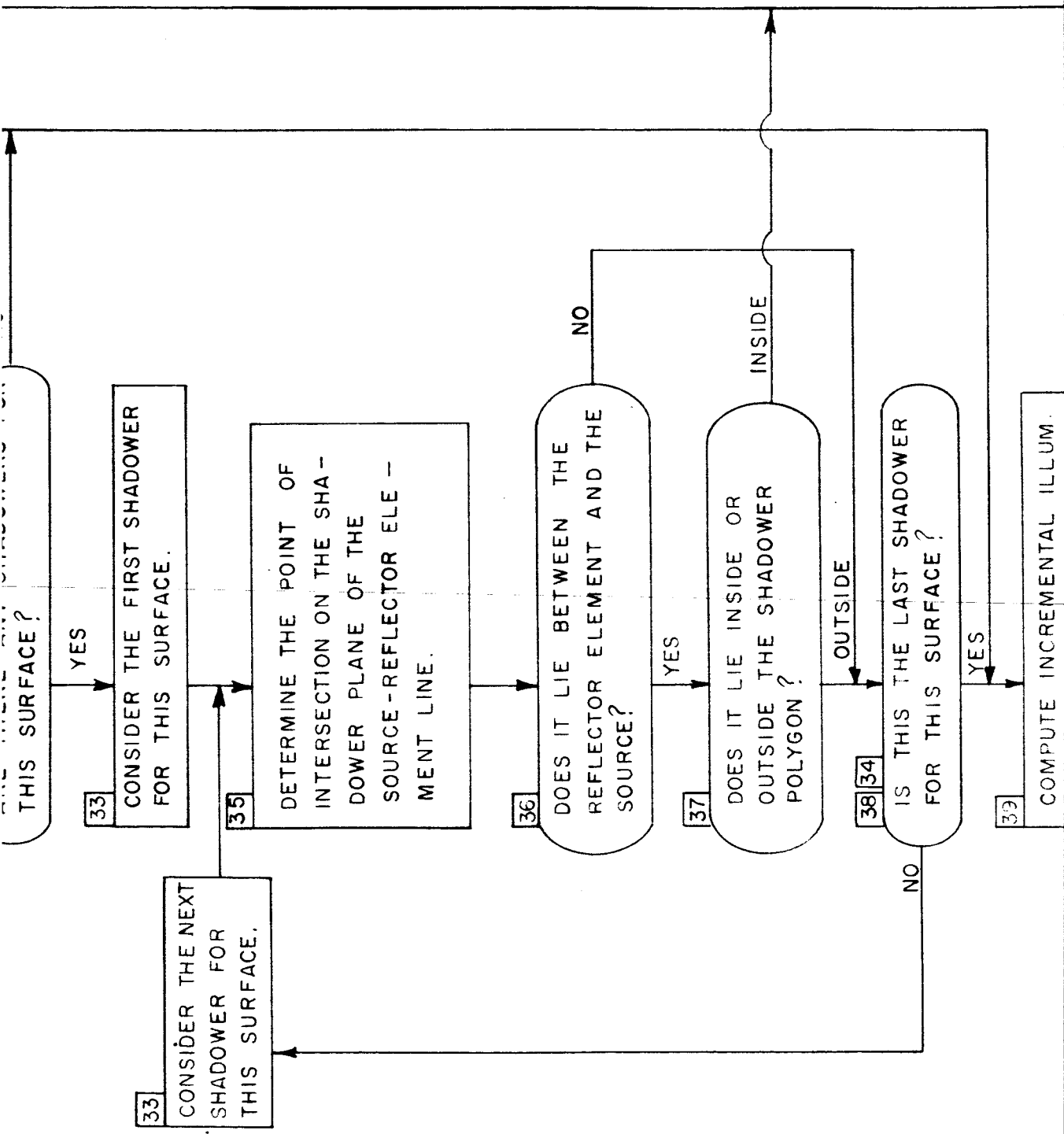
CONSIDER THE NEXT SHADOW FOR THIS SURFACE.

DETERMINE THE POINT OF INTERSECTION ON THE SHADOWER PLANE OF THE REFLECTOR ELEMENT OBSERVER LINE.

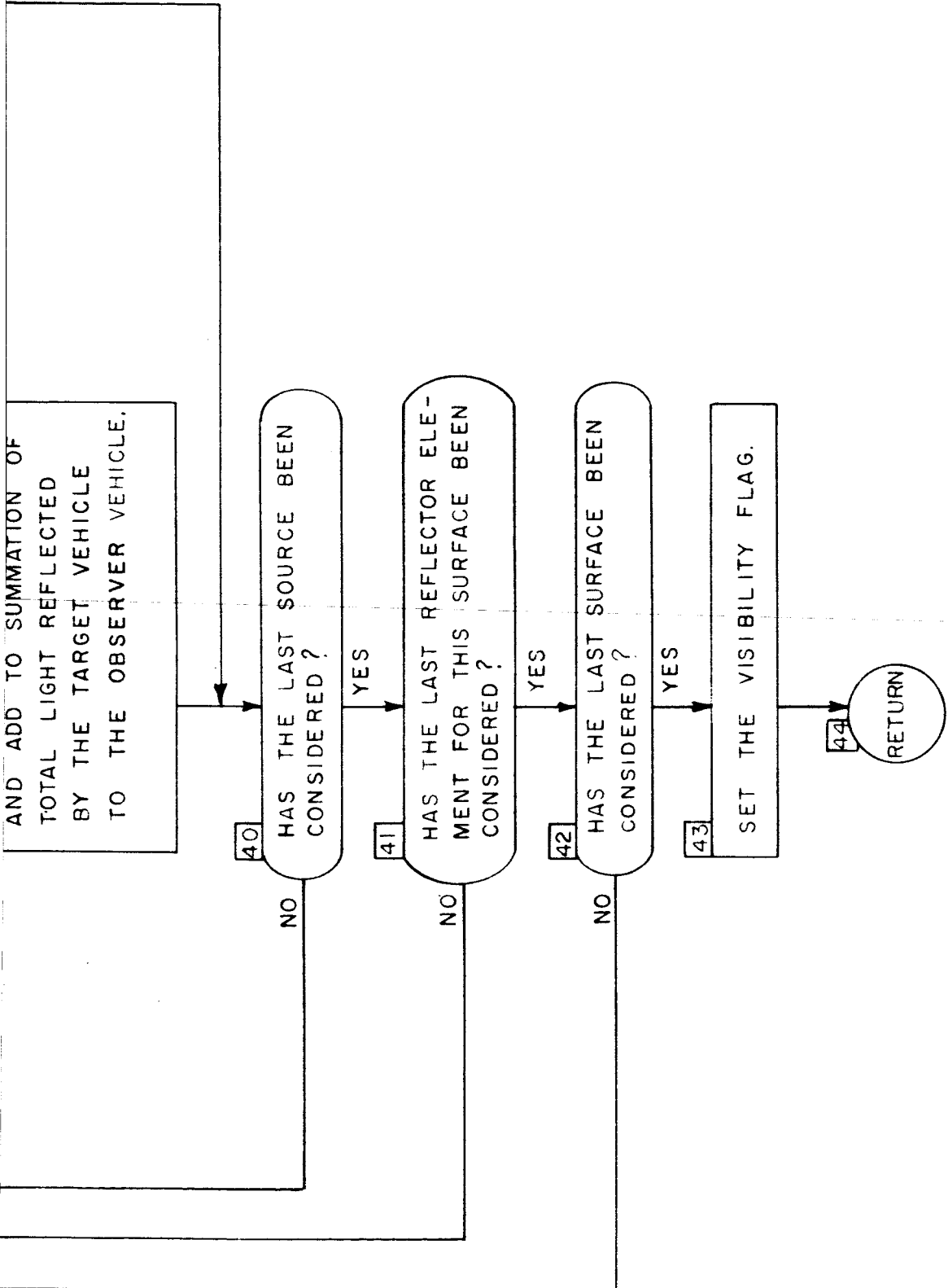




37 (6)



37 (7)





## 6.2 SYMBOLS, DEFINITIONS, UNITS

### SUBROUTINE TDM (PROGRAM 3960)

ALL QUANTITIES ARE IN TERMS OF METERS AND RADIANS, UNLESS OTHERWISE INDICATED.

ALL TARGET REFLECTOR ELEMENTS ARE GROUPED UNDER TARGET SURFACES. AS SUCH ALL REFLECTOR ELEMENTS OF A SURFACE ARE COATED WITH THE SAME MATERIAL AND ARE POTENTIALLY SHADOWABLE BY THE SAME SET OF SHADOWERS. (NSH MAX.)

### COORDINATE SYSTEMS

SCCS SELENOCENTRIC COORDINATE SYSTEM- THE X AXIS POINTS IN THE DIRECTION OF THE VERNAL EQUINOX. THE Z AXIS IS PARALLEL TO THE AXIS OF THE EARTH AND IS POSITIVE IN THE DIRECTION OF THE NORTH POLE. THE Y AXIS FORMS A RIGHT HANDED SYSTEM. THE ORIGIN IS AT THE CENTER OF THE MOON.

SVPS SUB-VEHICLE POINT COORDINATE SYSTEM- THE Z AXIS POINTS AT THE TARGET VEHICLE. THE Y AXIS IS IN THE X-Y PLANE OF THE SCCS. THE X AXIS FORMS A RIGHT HANDED SYSTEM. THE ORIGIN IS AT THE CENTER OF THE MOON.

TVCS TARGET VEHICLE COORDINATE SYSTEM- SEE REFERENCE 7 AND FIGURE 2.

### DICTIONARY

A AREA OF A MOON ELEMENT. THE DOUBLE AREA THAT A SHADOWER POLYGON SUBTENDS AT A PARTICULAR POINT IN THE SHADOWER PLANE.

ALPHA THE PHASE ANGLE BETWEEN THE SUN AND THE TARGET AT THE CENTER OF A PARTICULAR MOON ELEMENT (DEGREES)

ANGLE1 ONE HALF THE ANGLE SUBTENDED BY THE MOON AT THE TARGET

B ILLUMINATION OF THE OBSERVER VEHICLE BY THE TARGET VEHICLE IN LUMENS PER SQUARE FOOT

BPHPH1-6 SEE THE DICTIONARY FOR SUBROUTINE REFLEC

BTHPH1-6 SEE THE DICTIONARY FOR SUBROUTINE REFLEC

BURFH1-6 SEE THE DICTIONARY FOR SUBROUTINE REFLEC

COM3 UTILITY CELL

COM4 UTILITY CELL

CORNER THE STRING OF CORNER NUMBERS FOR THE FIRST CORNERS OF ALL SHADOWERS. THE LAST VALUE IS ONE PLUS THE CORNER NUMBER OF THE LAST CORNER OF THE LAST SHADOWER.

CORNF THE NUMBER OF THE FIRST CORNER OF A SHADOWER

CORNL THE NUMBER OF THE LAST CORNER OF A SHADOWER

COS1 =COS(ANGLE1)

COS2 THE COSINE OF THE ANGLE WHICH THE EARTH AND MOON SUBTEND AT THE TARGET

COS3 THE COSINE OF THE ANGLE WHICH THE SUN AND MOON SUBTEND AT THE TARGET

COSALF =COS(ALPHA)

COSPHI =COS(PHI) OR COS(PHIP)

COSTAU =COS(TAU)

COSTH =COS(THETA)

COSTHP =COS(THETAP)

CW THE WIDTH OF A COLUMN ON THE MOON IN RADIANS

E THE ILLUMINANCE OF THE SUN AT THE CENTER OF THE MOON (LIGHT WATT PER SQUARE METER)

EPOS THE EARTH VECTOR (SCCS)

EPOSX THE EARTH VECTOR IN EARTH RADII (SCCS)  
FLUX THE FACTOR INTRODUCED BY REFLECTION AT EACH LIGHT SOURCE (FLUX IS 1 FOR THE SUN.)  
FRN A LIST OF THE FIRST REFLECTOR ELEMENTS FOR EACH SURFACE. THE LAST VALUE IS ONE PLUS THE NUMBER OF THE LAST REFLECTOR FOR THE LAST SURFACE.  
FS THE NUMBER OF THE FIRST SOURCE, WHICH IS ILLUMINATED, WHICH IS NOT ECLIPSED, AND WHICH IS FACED BY THE PARTICULAR TARGET REFLECTOR ELEMENT BEING CONSIDERED  
H2 THE DISTANCE SQUARED BETWEEN THE EARTH AND THE TARGET  
KOM1 UTILITY CELL  
KOM2 UTILITY CELL  
MAT THE STRING OF MATERIAL CODE NUMBERS- ONE FOR EACH SURFACE  
MATT THE ATTITUDE MATRIX TRANSFORMS FROM THE SCCS TO THE TVCS  
MSVP THE SUB-VEHICLE POINT MATRIX TRANSFORMS FROM THE SCCS TO THE SVPS  
MSVPTR =TRS(MSVP)  
NC THE NUMBER OF COLUMNS ON THE VISIBLE PORTION OF THE SURFACE OF THE MOON  
NCOR THE TOTAL NUMBER OF CORNERS ON ALL SHADOWS  
NMAT THE NUMBER OF MATERIALS  
NPHIP THE NUMBER OF TABULAR VALUES OF PHIPRM  
NR THE NUMBER OF ROWS ON THE MOON  
NRE THE NUMBER OF REFLECTORS  
NS THE NUMBER OF LIGHT SOURCES  
NSH THE MAXIMUM NUMBER OF SHADOWS PER SURFACE. THE FIRST DIMENSION OF SHAD MUST BE EQUAL TO NSH.  
NSHAD THE NUMBER OF SHADOWS  
NSPECF THE NUMBER OF SPECF FLAGS. IF ALL VALUES OF SPECF ARE ZERO, NSPECF MUST BE SPECIFIED AS ZERO.  
NSURF THE NUMBER OF TARGET SURFACES  
NTH THE NUMBER OF TABULAR VALUES OF TH  
NTHP THE NUMBER OF TABULAR VALUES OF THTPRM  
OPOS THE OBSERVER VECTOR (SCCS)  
OPOSX THE OBSERVER VECTOR IN FEET (SCCS)  
F THE LENGTH OF THE NORMAL PROJECTION OF VZSV ON THE SCCS X-Y PLANE  
PHI THE PHASE ANGLE BETWEEN THE SUN AND THE TARGET AT THE EARTH. THE ANGLE THAT THE CENTER OF A MOON ELEMENT MAKES WITH THE X-Z PLANE AT THE Z AXIS IN THE SVPS.  
PHIP THE ANGLE BETWEEN THE PLANES IN WHICH THETA AND THETAP ARE MEASURED (DEGREES)  
PI =3.14159265  
PHIPRM TABULATED VALUES OF PHIP  
PHPH01-6 SEE THE DICTIONARY FOR SUBROUTINE REFLEC  
FSI THE ANGLE BETWEEN THE CENTER OF A MOON ELEMENT AND THE Z AXIS OF THE SVPS  
R TARGET REFLECTOR NUMBER  
RAD =180./PI  
RAREA THE ARRAY CONTAINING THE AREAS OF THE TARGET REFLECTOR ELEMENTS  
RAT10 =VUOV(2)/VUOV(1)  
RAT1S =VUTS(2,1,S)/VUTS(1,1,S)  
RAT20 =VUOV(3)/VUOV(1)  
RAT2S =VUTS(3,1,S)/VUTS(1,1,S)  
RE THE RADIUS OF THE EARTH  
RM THE RADIUS OF THE MOON

RW THE WIDTH OF A ROW ON THE MOON IN RADIANS  
 S SOURCE NUMBER  
 SH TARGET SHADOWER NUMBER  
 SHAD THE LISTS OF SHADOWERS CAPABLE OF SHADOWING THE VARIOUS SURFACES  
 SHADO =MOD(SHADOW,8)  
 SHADOW A FLAG WHICH INDICATES FOR WHICH OBJECTS TO CONSIDER TARGET SELF-SHADOWING. IF A TARGET REFLECTOR ELEMENT DOES NOT FACE THE DESIGNATED OBJECT, NO LIGHT IS REFLECTED BY THAT ELEMENT RELATIVE TO THAT OBJECT, REGARDLESS OF THIS FLAG. THE DESIGNATION OF SOURCE SHADOWING MEANS THAT A REFLECTOR ELEMENT WILL NOT REFLECT LIGHT FROM A SOURCE IF A SHADOWER ELEMENT INTERVENES BETWEEN THAT SOURCE AND REFLECTOR ELEMENT. THE DESIGNATION OF OBSERVER SHADOWING MEANS THAT A REFLECTOR ELEMENT WILL NOT REFLECT LIGHT TO THE OBSERVER IF A SHADOWER ELEMENT INTERVENES BETWEEN THAT REFLECTOR ELEMENT AND THE OBSERVER.  
     0 NONE  
     1 EARTH  
     2 SUN  
     3 EARTH AND SUN  
     4 MOON  
     5 EARTH AND MOON  
     6 SUN AND MOON  
     7 EARTH, SUN, AND MOON  
     8 OBSERVER  
     9 OBSERVER AND EARTH  
    10 OBSERVER AND SUN  
    11 OBSERVER, EARTH, AND SUN  
    12 OBSERVER AND MOON  
    13 OBSERVER, EARTH, AND MOON  
    14 OBSERVER, SUN, AND MOON  
    15 OBSERVER, EARTH, SUN, AND MOON  
 SHDAR THE ARRAY OF DOUBLE AREAS OF THE TARGET SHADOWERS  
 SHDCOR THE ARRAY OF VECTORS TO THE CORNERS OF THE VARIOUS SHADOWERS. THEY ARE ARRANGED CYCLICALLY FOR ANY ONE SHADOWER. (TVCS)  
 SIN1 =SIN(ANGLE1)  
 SINPSI =SIN(PHI)  
 SOURCE A FLAG WHICH INDICATES WHICH LIGHT SOURCES TO CONSIDER  
     0 NONE  
     1 EARTH  
     2 SUN  
     3 EARTH AND SUN  
     4 MOON  
     5 EARTH AND MOON  
     6 SUN AND MOON  
     7 EARTH, SUN, AND MOON  
 SPECF SEE THE DICTIONARY FOR SUBROUTINE REFLEC  
 SPOS THE SUN VECTOR (SCCS)  
 SPOSTR THE SUN VECTOR (SVPS)  
 SPOSX THE SUN VECTOR IN EARTH RADII (SCCS)  
 SURF THE SURFACE NUMBER OF A PARTICULAR TARGET REFLECTOR ELEMENT  
 TABLES 0 THE TARGET DESCRIPTION TABLES ON TAPE HAVE NOT BEEN READ  
           1 THE TARGET DESCRIPTION TABLES ON TAPE HAVE BEEN READ  
 TATT YAW, PITCH, AND ROLL  
 TAU THE ANGLE IN THE PHASE PLANE, AT THE CENTER OF A PARTICULAR MOON ELEMENT, WHICH IS THE NORMAL PROJECTION OF THE EMISSION ANGLE

(DEGREES)

TH TABULATED VALUES OF THETA

THETA THE ANGLE BETWEEN A PARTICULAR SOURCE AND THE NORMAL TO A PARTICULAR TARGET REFLECTOR ELEMENT AT THE CENTER OF THAT ELEMENT (DEGREES)

THETAP THE ANGLE BETWEEN THE OBSERVER AND THE NORMAL TO A PARTICULAR TARGET ELEMENT AT THE CENTER OF THAT TARGET ELEMENT (DEGREES)

THPH01-6 SEE THE DICTIONARY FOR SUBROUTINE REFLEC

THTPRM TABULATED VALUES OF THETAP

TOTAL THE SUM OF FLUX TIMES THE FACTOR INTRODUCED BY THE REFLECTION PROCESS AT EACH TARGET REFLECTOR ELEMENT

TPOS THE TARGET VECTOR (SCCS)

TPOSTR THE TARGET VECTOR (SVPS)

TPOSX THE TARGET VECTOR IN FEET (SCCS)

UDRH01-6 SEE THE DICTIONARY FOR SUBROUTINE REFLEC

UDRL01-6 SEE THE DICTIONARY FOR SUBROUTINE REFLEC

V3 THE VECTOR FROM THE CENTER OF A PARTICULAR MOON ELEMENT TO THE TARGET (SVPS)

VCOM1 UTILITY VECTOR

VCOM2 UTILITY VECTOR

VCOM3 UTILITY VECTOR

VIPTSH THE ARRAY OF VECTORS TO THE CORNERS OF A PARTICULAR SHADOWER FROM THE POINT OF INTERSECTION OF THAT SHADOWER PLANE AND A PARTICULAR SOURCE OR OBSERVER VECTOR (TVCS)

VIS A FLAG WHICH INDICATES WHICH LIGHT SOURCES ARE SEEN AT THE TARGET VEHICLE

0 NONE

1 EARTH

2 SUN

3 EARTH AND SUN

4 MOON

5 EARTH AND MOON

6 SUN AND MOON

7 EARTH, SUN, AND MOON

8 THE TARGET IS BELOW THE HORIZON OF THE MOON RELATIVE TO THE OBSERVER. VISIBILITY RELATIVE TO THE TARGET IS NOT DETERMINED BY SUBROUTINE TDM.

9 THE OBSERVER IS COINCIDENT WITH THE TVCS ORIGIN. THE MATH MODEL BREAKS DOWN. THE REFLECTED ILLUMINATION IS ARBITRARILY SET TO ZERO.

VMRS MOON ELEMENT VECTOR (SVPS)

VOV THE OBSERVER VECTOR (TVCS)

VPI THE VECTOR TO THE POINT OF INTERSECTION IN THE SHADOWER PLANE OF A SOURCE OR OBSERVER VECTOR (TVCS)

VTE THE ARRAY OF THE VECTORS TO THE CENTERS OF THE TARGET REFLECTOR ELEMENTS (TVCS)

VU2 THE UNIT VECTOR NORMAL TO THE PHASE PLANE AT THE CENTER OF A PARTICULAR MOON ELEMENT

VUMSN THE UNIT SUN VECTOR (SVPS)

VUMTS =UNIT(V3)

VUNS THE UNIT VECTOR NORMAL TO A PARTICULAR MOON ELEMENT (SVPS)

VUNSHD THE ARRAY OF UNIT VECTORS NORMAL TO THE TARGET SHADOWERS (TVCS)

VUNT THE ARRAY OF UNIT VECTORS NORMAL TO THE TARGET REFLECTOR ELEMENTS (TVCS)

VUOV THE UNIT OBSERVER VECTOR (TVCS)

VUTS THE ARRAY OF SOURCE VECTORS (TVCS)  
VXSV =VYSV\$VZSV  
VYSV THE UNIT VECTOR IN THE SCCS X-Y PLANE WHICH IS NORMAL TO VZSV  
VZSV UNIT TARGET VECTOR (SCCS)

DICTIONARY FOR SUBROUTINE REFLEC

BPHPH1 BEGINNING RELATIVE LOCATION FOR THE FIRST PHI PRIME, IN A STACK OF  
 PHI PRIMES, FOR EACH THETA CONTAINING A HIGH DENSITY TABLE, FOR  
 MATERIAL NO 1. THE LAST BEGINNING-RELATIVE-LOCATION IS A SYNTHETIC  
 LOCATION = THE RELATIVE LOCATION + 1 OF THE LAST PHI PRIME IN THE STACK  
 BPHPH2 SAME AS BPHPH1, EXCEPT FOR MATERIAL 2  
 BPHPH3 SAME AS BPHPH1, EXCEPT FOR MATERIAL 3  
 BPHPH4 SAME AS BPHPH1, EXCEPT FOR MATERIAL 4  
 BPHPH5 SAME AS BPHPH1, EXCEPT FOR MATERIAL 5  
 BPHPH6 SAME AS BPHPH1, EXCEPT FOR MATERIAL 6  
 BTHPH1 BEGINNING RELATIVE LOCATION FOR THE FIRST THETA PRIME, IN A STACK  
 OF THETA PRIMES, FOR EACH THETA CONTAINING A HIGH DENSITY TABLE  
 FOR MATERIAL 1. THE LAST BEGINNING-RELATIVE-LOCATION IS A SYNTHETIC  
 LOCATION= THE RELATIVE LOCATION + 1 OF THE LAST THETA PRIME IN THE STACK  
 BTHPH2 SAME AS BTHPH1, EXCEPT FOR MATERIAL 2  
 BTHPH3 SAME AS BTHPH1, EXCEPT FOR MATERIAL 3  
 BTHPH4 SAME AS BTHPH1, EXCEPT FOR MATERIAL 4  
 BTHPH5 SAME AS BTHPH1, EXCEPT FOR MATERIAL 5  
 BTHPH6 SAME AS BTHPH1, EXCEPT FOR MATERIAL 6  
 BURFH1 BEGINNING INDEX FOR EACH THETA THAT CONTAINS A HIGH DENSITY TABLE  
 INDICATING THE BEGINNING OF THE BI-DIRECTIONAL HIGH DENSITY DATA  
 BURFH2 SAME AS BURFH1, EXCEPT MATERIAL 2  
 BURFH3 SAME AS BURFH1, EXCEPT MATERIAL 3  
 BURFH4 SAME AS BURFH1, EXCEPT MATERIAL 4  
 BURFH5 SAME AS BURFH1, EXCEPT MATERIAL 5  
 BURFH6 SAME AS BURFH1, EXCEPT MATERIAL 6  
 K NUMBER OF TABULATED THETAS  
 M NUMBER OF LOW DENSITY TABULATED PHI PRIMES  
 MAT MATERIAL CODE NUMBER--SUBROUTINE ARGUMENT  
 N NUMBER OF LOW DENSITY TABULATED THETA PRIMES  
 PHP PHI PRIME, THE ANGLE BETWEEN THE TWO PLANES IN WHICH TH AND THP  
 ARE DETERMINED--SUBROUTINE ARGUMENT  
 PHIPRM LOW DENSITY TABULATED VALUES OF PHP  
 PHPH01 STACK OF HIGH DENSITY TABULATED PHI PRIMES FOR MATERIAL 1  
 PHPH02 STACK OF HIGH DENSITY TABULATED PHI PRIMES FOR MATERIAL 2  
 PHPH03 STACK OF HIGH DENSITY TABULATED PHI PRIMES FOR MATERIAL 3  
 PHPH04 STACK OF HIGH DENSITY TABULATED PHI PRIMES FOR MATERIAL 4  
 PHPH05 STACK OF HIGH DENSITY TABULATED PHI PRIMES FOR MATERIAL 5  
 PHPH06 STACK OF HIGH DENSITY TABULATED PHI PRIMES FOR MATERIAL 6  
 SPECF SPECULAR FLAG FOR EACH MATERIAL AND FOR EACH THETA WITHIN EACH MATERIAL.  
 TELLS IF THE BI-DIRECTIONAL DATA FOR THAT THETA CONTAINS A HIGH DENSITY  
 TABLE IN ADDITION TO THE LOW DENSITY TABLE. THIS HIGH DENSITY TABLE  
 IS FOR USE WHERE THE BI DIRECTIONAL FUNCTION IS CHANGING RAPIDLY  
 =0 NO HIGH DENSITY TABLE  
 =1 HIGH DENSITY TABLE  
 TH THETA , THE ANGLE BETWEEN THE INCIDENT ENERGY RAY AND THE NORMAL TO THE  
 REFLECTING TARGET ELEMENT--SUBROUTINE ARGUMENT  
 THETA TABULATED VALUES OF TH  
 THP THETA PRIME, THE ANGLE BETWEEN THE NORMAL TO THE TARGET ELEMENT AND  
 THE LINE BETWEEN THAT ELEMENT AND OBSERVER--SUBROUTINE ARGUMENT  
 THPH01 STACK OF HIGH DENSITY TABULATED THETA PRIMES FOR MATERIAL 1  
 THPH02 STACK OF HIGH DENSITY TABULATED THETA PRIMES FOR MATERIAL 2  
 THPH03 STACK OF HIGH DENSITY TABULATED THETA PRIMES FOR MATERIAL 3  
 THPH04 STACK OF HIGH DENSITY TABULATED THETA PRIMES FOR MATERIAL 3

THPH04 STACK OF HIGH DENSITY TABULATED THETA PRIMES FOR MATERIAL 4  
THPH05 STACK OF HIGH DENSITY TABULATED THETA PRIMES FOR MATERIAL 5  
THPH06 STACK OF HIGH DENSITY TABULATED THETA PRIMES FOR MATERIAL 6  
THPRM LOW DENSITY TABULATED VALUES OF THP  
UDRH01 HIGH DENSITY BI DIRECTIONAL FUNCTION MATERIAL 1  
UDRH02 HIGH DENSITY BI DIRECTIONAL FUNCTION MATERIAL 2  
UDRH03 HIGH DENSITY BI DIRECTIONAL FUNCTION MATERIAL 3  
UDRH04 HIGH DENSITY BI DIRECTIONAL FUNCTION MATERIAL 4  
UDRH05 HIGH DENSITY BI DIRECTIONAL FUNCTION MATERIAL 5  
UDRH06 HIGH DENSITY BI DIRECTIONAL FUNCTION MATERIAL 6  
UDRL01 LOW DENSITY BI DIRECTIONAL FUNCTION MATERIAL 1  
UDRL02 LOW DENSITY BI DIRECTIONAL FUNCTION MATERIAL 2  
UDRL03 LOW DENSITY BI DIRECTIONAL FUNCTION MATERIAL 3  
UDRL04 LOW DENSITY BI DIRECTIONAL FUNCTION MATERIAL 4  
UDRL05 LOW DENSITY BI DIRECTIONAL FUNCTION MATERIAL 5  
UDRL06 LOW DENSITY BI DIRECTIONAL FUNCTION MATERIAL 6

### 6.3 ASSUMPTIONS

#### ASSUMPTIONS

THE ILLUMINATION OF THE SUN IS CALCULATED ONLY ONCE- AT THE CENTER OF THE MOON. THIS FIGURE IS USED AT THE CENTER OF THE EARTH, IS USED FOR ALL MOON ELEMENTS, AND IS USED FOR ALL TARGET REFLECTOR ELEMENTS.

ONE VECTOR, FROM THE CENTER OF THE MOON TO THE CENTER OF THE SUN, IS USED INSTEAD OF INDIVIDUAL VECTORS FROM THE CENTER OF EACH MOON ELEMENT TO THE CENTER OF THE SUN.

ONE VECTOR, FROM THE ORIGIN OF THE TVCS TO THE CENTER OF EACH SOURCE, IS USED INSTEAD OF INDIVIDUAL VECTORS FROM THE CENTER OF EACH TARGET REFLECTOR ELEMENT TO THE CENTER OF EACH SOURCE.

ONE VECTOR, FROM THE ORIGIN OF THE TVCS TO THE CENTER OF THE OBSERVER VEHICLE, IS USED INSTEAD OF INDIVIDUAL VECTORS FROM THE CENTER OF EACH TARGET REFLECTOR ELEMENT TO THE CENTER OF THE OBSERVER VEHICLE.

ALL LIGHT SOURCES ARE REGARDED AS POINT SOURCES.

THE LUMPED PARAMETER CONCEPT IS USED IN DIVIDING THE MOONS SURFACE UP INTO ELEMENTAL REFLECTORS.

THE LUMPED PARAMETER CONCEPT IS USED IN DIVIDING THE TARGET VEHICLE UP INTO REFLECTING ELEMENTS.

SURFACES ON THE TARGET VEHICLE WHICH CAN SHADOW OTHER SURFACES ON THE TARGET VEHICLE ARE APPROXIMATED WITH POLYGONS, FOR SHADOWING PURPOSES ONLY.

THE MOON NEVER ECLIPSES THE EARTH FROM THE SUN.

THE EARTH NEVER ECLIPSES THE MOON FROM THE SUN.

THE OBSERVER VEHICLE NEVER SHADOWS ANYTHING.

THE TARGET VEHICLE ONLY SHADOWS ITSELF.

THE ONLY LIGHT SOURCES ILLUMINATING THE TARGET VEHICLE ARE THE SUN, THE MOON, AND THE EARTH.

THERE IS NO LIGHT TRANSFER BETWEEN THE EARTH AND THE MOON.



6.4 SUBROUTINE LISTING

```

SUBROUTINE TDM
C   VISIBILITY SUBROUTINE (PROGRAM 3960)
C
C   PROGRAMMED BY BRECKENRIDGE-GENERAL DYNAMICS/CONVAIR
C
C   MAXIMUM ALLOWABLES- 2450 REFLECTORS, 75 SURFACES, 50 SHADOWERS, 20
C   CORNERS PER SHADOWER, AND A TOTAL OF 400 CORNERS.
C
C   NR*NC IS AUTOMATICALLY RESTRICTED TO THE RANGE 1 TO 400.
C
C   THE NUMBERS IN COLUMNS 74 AND 75 ARE THE BLOCK IDENTIFICATION NUM-
C   BERS ON THE FLOW CHART.
C
COMMON /NASA/SPOX,EPOX,TPOX,OPOX,TATT,SOURCE,SHADOW,NR,NC,VIS,
1B
COMMON/RFTLOW/UDRL01(1500),UDRL02(1500),UDRL03(1500),UDRL04(1500),
1UDRL05(1500),UDRL06(1500),TH(10),THTPRM(10),PHIPRM(15),SPECF(60),
2NPHIP,NTHP,NTH
COMMON/RFTHI/UDRH01(90),UDRH02(90),UDRH03(90),UDRH04(90),UDRH05(90
1),UDRH06(90),
2PHPH01(30),PHPH02(30),PHPH03(30),PHPH04(30),PHPH05(30),PHPH06(30),
3THPH01(30),THPH02(30),THPH03(30),THPH04(30),THPH05(30),THPH06(30),
4BPHPH1(11),BPHPH2(11),BPHPH3(11),BPHPH4(11),BPHPH5(11),BPHPH6(11),
5BTHPH1(11),BTHPH2(11),BTHPH3(11),BTHPH4(11),BTHPH5(11),BTHPH6(11),
6BURFH1(10),BURFH2(10),BURFH3(10),BURFH4(10),BURFH5(10),BURFH6(10)
DIMENSION A00001(3,1),A00002(3,1),A00003(3,1),A00004(3,1),A00005(3
1,1),A00006(3,1),A00007(3,1),A00008(3,1),A00009(3,1),A00010(3,1),A0
20011(3,1),A00012(3,1),A00013(3,1),A00014(3,1),A00015(3,1),A00016(3
3,1),A00017(3,1),A00018(3,1),A00019(3,3),A00020(3,1),A00021(3,1),A0
40022(3,1),A00023(3,1),A00024(3,1),A00025(3,1),A00026(3,1),A00027(3
5,1),A00028(3,1),A00029(3,1),A00030(3,1),A00031(3,1),A00032(3,1),A0
60033(3,1),A00034(3,1),CORNER(51),EPOS(3,1),EPOX(3,1),FLUX(402),FR
7N(76),MAT(75),MATT(3,3),MSVP(3,3),MSVPTR(3,3),OPOS(3,1),OPOX(3,1)
8,RAREA(2450),SHAD(3,75),SHDAR(50),SHDCOR(3,1,400),SPOS(3,1),SPOSTR
9(3,1),SPOX(3,1),TATT(3),TPOS(3,1),TPOSTR(3,1),TPOX(3,1),V3(3)
DIMENSION VCOM1(3,1),VCOM2(3,1),VCOM3(3,1),VIPTSH(3,1,20),VMRS(3,1
1),VOV(3,1),VPI(3,1),VTE(3,1,2450),VU2(3,1),VUMSN(3,1),VUMTS(3,1),V
2UNS(3,1),VUNSHD(3,1,50),VUNT(3,1,2450),VUOV(3,1),VUTS(3,1,402),VXS
3V(3,1),VYSV(3,1),VZSV(3,1)
REAL JPLLRM,MATT,MSVP,MSVPTR
INTEGER CORNER,CORNF,CORNLF,FS,R,S,SH,SHAD,SHADO,SHADOW,SOURCE,SURF
1,FRN,VIS
INTEGER SPECF,BPHPH1,BPHPH2,BPHPH3,BPHPH4,BPHPH5,BPHPH6,BTHPH1,BTH
*PH2,BTHPH3,BTHPH4,BTHPH5,BTHPH6,BURFH1,BURFH2,BURFH3,BURFH4,BURFH5
*,BURFH6
DATA NSH/3/,PI/3.14159265/,RAD/57.2957795/,RE/6378000./,RM/1738000
1./,SPECF/60*0/,TABLES/0./
IF(TABLES.EQ.1.)GO TO 102
C
C   READ TARGET TABLES FROM TAPE
C   TABLES=1.
C   SURFACE AND REFLECTOR GEOMETRY
READ(1)NSURF,NRE,NSHAD
KOM=NSURF+1
READ(1)(MAT(I),I=1,NSURF),(FRN(I),I=1,KOM),((SHAD(J,I),J=1,3),I=1,
2NSURF),(RAREA(I),I=1,NRE),((VTE(J,1,I),J=1,3),I=1,NRE),

```

```
3((VUNT(J,1,I),J=1,3),I=1,NRE)
IF(NSHAD.EQ.0)GO TO 100
```

C SHADOWER GEOMETRY

```
KOM=NSHAD+1
READ(1)NCOR,(SHDAR(I),I=1,NSHAD),(CORNER(I),I=1,KOM),((VUNSHD(J,1,
1I),J=1,3),I=1,NSHAD),((SHDCOR(J,1,I),J=1,3),I=1,NCOR)
```

C LOW DENSITY REFLECTIVITY

```
100 READ(1)NTH,NTHP,NPHIP,NSPECF,NMAT,(TH(I),I=1,NTH),(THTPRM(I),I=1,
1NTHP),(PHIPRM(I),I=1,NPHIP)
KOM=NTH*NTHP*NPHIP
READ(1)(UDRL01(I),I=1,KOM)
IF(NMAT.EQ.1)GO TO 101
READ(1)(UDRL02(I),I=1,KOM)
IF(NMAT.EQ.2)GO TO 101
READ(1)(UDRL03(I),I=1,KOM)
IF(NMAT.EQ.3)GO TO 101
READ(1)(UDRL04(I),I=1,KOM)
IF(NMAT.EQ.4)GO TO 101
READ(1)(UDRL05(I),I=1,KOM)
IF(NMAT.EQ.5)GO TO 101
READ(1)(UDRL06(I),I=1,KOM)
101 IF(NSPECF.EQ.0)GO TO 102
```

C HIGH DENSITY REFLECTIVITY

```
READ(1)(SPECF(I),I=1,NSPECF)
READ(1)BURFH1,BTHPH1,BPHPH1,THPH01,PHPH01,UDRH01
IF(NMAT.EQ.1)GO TO 102
READ(1)BURFH2,BTHPH2,BPHPH2,THPH02,PHPH02,UDRH02
IF(NMAT.EQ.2)GO TO 102
READ(1)BURFH3,BTHPH3,BPHPH3,THPH03,PHPH03,UDRH03
IF(NMAT.EQ.3)GO TO 102
READ(1)BURFH4,BTHPH4,BPHPH4,THPH04,PHPH04,UDRH04
IF(NMAT.EQ.4)GO TO 102
READ(1)BURFH5,BTHPH5,BPHPH5,THPH05,PHPH05,UDRH05
IF(NMAT.EQ.5)GO TO 102
READ(1)BURFH6,BTHPH6,BPHPH6,THPH06,PHPH06,UDRH06
102 IF ((SOURCE).NE.((0))) GO TO 2
```

```
1 B=0.
VIS=(0)
GO TO 7B
2 CALL MADD2(3,1,TPOX,+1.,OPOX,-1.,A00034)
IF ((VMAG(A00034,3)).NE.((0.))) GO TO 3
B=0.
VIS=9
GO TO 7B
```

C BOUND NR\*NC

```
3 IF ((NR)*(NC).LE.((0))) GO TO 4
IF ((NR)*(NC).LE.((400))) GO TO 5
4 NR=(40)
NC=(10)
5 FNR=(NR)
FNC=(NC)
```

C CONVERT VECTORS TO METERS

```
CALL MADD1(3,1,SPOX,RE,SPOS)
CALL MADD1(3,1,EPOX,RE,EPOS)
CALL MADD1(3,1,OPOX,+ .3048 ,OPOS)
```

```
CALL MADD1(3,1,TPOX,+ .3048 ,TPOS)
IF ((VMAG(TPOS,3)).LT.(RM)+(1.)) GO TO 6
GO TO 7
```

```
6 CONTINUE
```

```
CALL UNIT(TPOS,A00001,3)
CALL MADD1(3,1,A00001,RM+1.,TPOS)
```

```
7 CONTINUE
```

```
C DOES THE MOON BLOCK VISUAL CONTACT BE-
C TWEEN THE OBSERVER AND THE TARGET.
```

```
CALL MADD2(3,1,OPOS,+1.,TPOS,-1.,A00002)
IF ((VMAG(A00002,3)).LE.(SQRT((VMAG(OPOS,3))**(2)-(RM)**(2)))) GO
1 TO 8
```

```
CALL MADD2(3,1,OPOS,+1.,TPOS,-1.,A00003)
CALL UNIT(A00003,A00004,3)
CALL UNIT(OPOS,A00005,3)
```

```
IF ((VDOT(A00004,A00005,3)).LT.(SQRT((1.)-((RM)/(VMAG(OPOS,3)))*
1*(2)))) GO TO 8
```

```
C YES
```

```
B= 0.
VIS=(8)
GO TO 78
```

```
C NO. DETERMINE THE ATTITUDE MATRIX.
```

```
8 SINY=(SIN((TATT(1))))
COSY=(COS((TATT(1))))
SINP=(SIN((TATT(2))))
COSP=(COS((TATT(2))))
SINR=(SIN((TATT(3))))
COSR=(COS((TATT(3))))
MATT(1,1)=(COSP)*(COSR)
MATT(2,1)=- (COSP)*(SINR)
MATT(3,1)=(SINP)
MATT(1,2)=(SINY)*(SINP)*(COSR)+(COSY)*(SINR)
MATT(2,2)=- (SINY)*(SINP)*(SINR)+(COSY)*(COSR)
MATT(3,2)=- (SINY)*(COSP)
MATT(1,3)=- (COSY)*(SINP)*(COSR)+(SINY)*(SINR)
MATT(2,3)=(COSY)*(SINP)*(SINR)+(SINY)*(COSR)
MATT(3,3)=(COSY)*(COSP)
```

```
C SIN1=(RM)/(VMAG(TPOS,3))
C ANGLE1=(ASIN((SIN1)))
C COS1=(COS((ANGLE1)))
C CALL UNIT(TPOS,VZSV,3)
C NS=(0)
C FLUX(1)= 0.
C FLUX(2)= 0.
```

```
C IS THE EARTH CONSIDERED AS A LIGHT
C SOURCE.
```

```
GO TO (9,14,9,14,9,14,9), SOURCE
```

```
C YES. IS THE EARTH BELOW THE HORIZON OF
C THE MOON RELATIVE TO THE TARGET.
```

```
9 CALL MADD2(3,1,TPOS,+1.,EPOS,-1.,VCOM1)
H2=(VCOM1(1,1))**(2)+(VCOM1(2,1))**(2)+(VCOM1(3,1))**(2)
CALL MADD1(3,1,VCOM1,+1./ (SQRT((H2))),VCOM2)
COS2= VDOT(VCOM2,VZSV,3)
IF ((COS2).GE.(COS1)) GO TO 14
```

```

C.                                     NO. DETERMINE EARTH LIGHT.
CALL MADD2(3,1,SPOS,+1.,EPOS,-1.,A00006)
CALL UNIT(A00006,A00007,3)
COSPHI= VDOT(A00007,VCOM2,3)
IF ((COSPHI).GT.((1.))) GO TO 10
GO TO 11
10 CONTINUE
COSPHI= 1.
11 CONTINUE
IF ((COSPHI).LT.(-(1.))) GO TO 12
GO TO 13
12 CONTINUE
COSPHI=- 1.
13 CONTINUE
PHI=(ACOS((COSPHI)))
FLUX(1)= 2. / 3. * .4 *(RE)**(2)/(H2)*(SIN((PHI))+((PI)-(PHI))*(CO
1SPHI))/PI)
CALL MTMPY(MATT,VCOM2,A00008,3,3,1)
CALL MADD1(3,1,A00008,-1.,VUTS(1,1,1))
NS=(1)
C                                     IS THE SUN BELOW THE HORIZON OF THE
C                                     MOON RELATIVE TO THE TARGET.
14 CALL MADD2(3,1,TPOS,+1.,SPOS,-1.,A00009)
CALL UNIT(A00009,VCOM3,3)
COS3= VDOT(VCOM3,VZSV,3)
IF ((COS3).GE.(COS1)) GO TO 32
C                                     NO. IS THE SUN CONSIDERED AS A LIGHT
C                                     SOURCE.
NS=(2)
GO TO (15,16,16,17,17,16,16), SOURCE
C                                     NO
15 NS=(1)
IF ((FLUX(1))) 33,1,33
C                                     YES. DETERMINE SUN LIGHT.
16 CALL MTMPY(MATT,VCOM3,A00010,3,3,1)
CALL MADD1(3,1,A00010,-1.,VUTS(1,1,2))
FLUX(2)= 1.
C                                     IS THE MOON CONSIDERED AS A SERIES OF
C                                     LIGHT SOURCES.
IF ((SOURCE).LE.((3))) GO TO 32
C                                     YES. DETERMINE THE SUB-VEHICLE POINT
C                                     MATRIX.
17 P=(SQRT((VZSV(1,1))**(2)+(VZSV(2,1))**(2)))
IF ((P).GT.((0.))) GO TO 18
MSVP(1,1)= 1.
MSVP(2,1)= 0.
MSVP(3,1)= 0.
MSVP(1,2)= 0.
MSVP(2,2)= 1.
MSVP(3,2)= 0.
MSVP(1,3)= 0.
MSVP(2,3)= 0.
MSVP(3,3)= 1.
GO TO 20
18 VYSV(1,1)=(VZSV(2,1))/(P)

```

```

VYSV(2,1)=- (VZSV(1,1))/(P)
VYSV(3,1)= 0.
CALL VCRS(VYSV,VZSV,VXSV)
DO 19 I=1,3
MSVP(1,I)=(VXSV(I,1))
MSVP(2,I)=(VYSV(I,1))
MSVP(3,I)=(VZSV(I,1))

```

```
19 CONTINUE
```

```
20 CALL TRS(MSVP,MSVPTR,3,3)
```

C

MOON LIGHT

14

```
CALL MTMPY(MSVP,SPOS,SPOSTR,3,3,1)
```

```
CALL UNIT(SPOSTR,VUMSN,3)
```

```
CALL MTMPY(MSVP,TPOS,TPOSTR,3,3,1)
```

```
CW=((PI)/ 2. -(ANGLE1))/(FNC)
```

```
RW= 2. *(PI)/(FNR)
```

```
DO 31 J=1,NC
```

```
FJ=(J)
```

```
PSI=(CW)*((FJ)- .5 )
```

```
SINPSI=(SIN((PSI)))
```

```
A=(CW)*(RW)*(SINPSI)*(RM)**(2)
```

```
VUNS(3,1)=(COS((PSI)))
```

```
DO 30 I=1,NR
```

```
NS=(NS)+(1)
```

```
FI=(I)
```

```
PHI=(RW)*((FI)- .5 )
```

```
VUNS(1,1)=(SINPSI)*(COS((PHI)))
```

```
VUNS(2,1)=(SINPSI)*(SIN((PHI)))
```

```
IF ((VDOT(VUNS,VUMSN,3)).GT.((0.))) GO TO 21
```

```
FLUX(NS)= 0.
```

```
GO TO 30
```

```
21 CALL MADD1(3,1,VUNS,RM,VMRS)
```

```
CALL MADD2(3,1,TPOSTR,+1.,VMRS,-1.,V3)
```

```
CALL UNIT(V3,VUMTS,3)
```

```
COSALF= VDOT(VUMTS,VUMSN,3)
```

```
IF ((COSALF).GT.((1.))) GO TO 22
```

```
GO TO 23
```

```
22 CONTINUE
```

```
COSALF= 1.
```

```
23 CONTINUE
```

```
IF ((COSALF).LT.(-(1.))) GO TO 24
```

```
GO TO 25
```

```
24 CONTINUE
```

```
COSALF= 1.
```

```
25 CONTINUE
```

```
ALPHA=(RAD)*(ACOS((COSALF)))
```

```
CALL VCRS(VUMTS,VUMSN,A00011)
```

```
CALL UNIT(A00011,VU2,3)
```

```
CALL VCRS(VU2,VUNS,A00012)
```

```
CALL VCRS(A00012,VU2,A00013)
```

```
CALL UNIT(A00013,VCOM1,3)
```

```
COSTAU= VDOT(VUMTS,VCOM1,3)
```

```
IF ((COSTAU).GT.((1.))) GO TO 26
```

```
GO TO 27
```

```
26 CONTINUE
```

```
COSTAU= 1.
```

```

27 CONTINUE
   TAU=(RAD)*(ACOS((COSTAU)))
   IF (COSALF*COSTAU.LT.VDOT(VUMSN,VCOM1,3)) TAU=-TAU
   FLUX(NS)=+(JPLLRM((ALPHA),(TAU)))*(A)/(VMAG(V3,3))*((2)*VDOT(VUMTS
1,VUNS,3)
   CALL MTMPY(MATT,MSVPTR,A00019,3,3,3)
   CALL MTMPY(A00019,VUMTS,A00020,3,3,1)
   CALL MADD1(3,1,A00020,-1.,VUTS(1,1,NS))
30 CONTINUE
31 CONTINUE
C
                                REFLECTION PROCESS AT TARGET
32 IF ((NS).EQ.((0))) GO TO 1
33 CALL MADD2(3,1,OPOS,+1.,TPOS,-1.,A00021)
   CALL MTMPY(MATT,A00021,VOV,3,3,1)
   CALL UNIT(VOV,VUOV,3)
   RAT10=(VUOV(2,1))/(VUOV(1,1))
   RAT20=(VUOV(3,1))/(VUOV(1,1))
   TOTAL= 0.
   SHADO=(SHADOW)
   IF ((SHADO).GE.((8))) GO TO 34
   GO TO 35
34 CONTINUE
   SHADO=(SHADO)-(8)
35 CONTINUE
C
                                CONSIDER A NEW TARGET SURFACE
DO 70 SURF=1,NSURF
KOM1=(FRN(SURF))
KOM2=(FRN(SURF+1))-(1)
C
                                CONSIDER A NEW TARGET REFLECTOR ELE-
C
                                MENT
DO 69 R=KOM1,KOM2
C
                                DOES IT FACE THE OBSERVER
COSTHP= VDOT(VUNT(1,1,R),VUOV,3)
IF ((COSTHP).LE.((0.))) GO TO 69
C
                                YES. DOES IT FACE AT LEAST ONE SOURCE.
DO 36 FS=1,NS
IF ((FLUX(FS)).EQ.((0.))) GO TO 36
IF (( VDOT(VUNT(1,1,R),VUTS(1,1,FS),3)).GT.((0.))) GO TO 37
36 CONTINUE
C
                                NO
GO TO 69
C
                                YES. IS SHADOWING CONSIDERED RELATIVE
C
                                TO THE OBSERVER.
37 IF ((SHADOW).LT.((8))) GO TO 44
C
                                YES. IS THE OBSERVER SHADOWED FROM
C
                                THE TARGET REFLECTOR ELEMENT.
DO 43 K=1,NSH
SH=(SHAD(K,SURF))
IF ((SH).EQ.((0))) GO TO 44
C
                                DETERMINE THE POINT OF INTERSECTION
C
                                BETWEEN THE TARGET SHADOWER PLANE AND
C
                                THE REFLECTOR-OBSERVER LINE.
CORNF=(CORNER(SH))
IF ((VUOV(1,1)).NE.((0.))) GO TO 39
IF ((VUOV(2,1)).NE.((0.))) GO TO 38

```

```

IF ((ABS((VUNSHD(3,1,SH))),LE.(.00001))) GO TO 43
VPI(1,1)=(VTE(1,1,R))
VPI(2,1)=(VTE(2,1,R))
VPI(3,1)=((VUNSHD(1,1,SH))*((SHDCOR(1,1,CORNF))-(VTE(1,1,R)))+(VUN
1SHD(2,1,SH))*((SHDCOR(2,1,CORNF))-(VTE(2,1,R)))+(VUNSHD(3,1,SH))*((
2SHDCOR(3,1,CORNF))))/(VUNSHD(3,1,SH))
GO TO 40

```

```

38 COM3=(VUOV(3,1))/(VUOV(2,1))
COM4=(VUNSHD(2,1,SH)+(VUNSHD(3,1,SH))*(COM3)
IF ((ABS((COM4))),LE.(.00001))) GO TO 43
VPI(1,1)=(VTE(1,1,R))
VPI(2,1)=((VUNSHD(1,1,SH))*((SHDCOR(1,1,CORNF))-(VTE(1,1,R)))+(VUN
1SHD(2,1,SH))*((SHDCOR(2,1,CORNF)))+(VUNSHD(3,1,SH))*((COM3)*(VTE(2,1
2,R)))+(SHDCOR(3,1,CORNF))-(VTE(3,1,R)))/(COM4)
VPI(3,1)=(VTE(3,1,R)+(COM3)*(VPI(2,1))-(VTE(2,1,R)))
GO TO 40

```

```

39 COM3=(VUNSHD(1,1,SH)+(RAT10)*(VUNSHD(2,1,SH)+(RAT20)*(VUNSHD(3,1
1,SH))
IF ((ABS((COM3))),LE.(.00001))) GO TO 43
VPI(1,1)=((VUNSHD(1,1,SH))*(SHDCOR(1,1,CORNF))+(VUNSHD(2,1,SH))*((
1RAT10)*(VTE(1,1,R))-(VTE(2,1,R)))+(SHDCOR(2,1,CORNF)))+(VUNSHD(3,1,
2SH))*((RAT20)*(VTE(1,1,R))-(VTE(3,1,R)))+(SHDCOR(3,1,CORNF)))/(COM
33)
COM4=(VPI(1,1))-(VTE(1,1,R))
VPI(2,1)=(RAT10)*(COM4)+(VTE(2,1,R))
VPI(3,1)=(RAT20)*(COM4)+(VTE(3,1,R))

```

C DOES IT LIE BETWEEN THE TARGET REFLEC-  
C TOR ELEMENT AND THE OBSERVER.

```

40 CALL MADD2(3,1,VPI,+1.,VTE(1,1,R),-1.,A00022) 26
CALL UNIT(A00022,A00023,3)
IF ((VDOT(VUNT(1,1,R),A00023,3)),LE.(0.)) GO TO 43

```

C YES. CONSTRUCT VECTORS FROM THE POINT  
C OF INTERSECTION TO THE CORNERS OF THE  
C SHADOWER POLYGON.

```

CORN1=(CORNER(SH+1))-(1) 27
J=(0)
DO 41 I=CORNF,CORN1
J=(J)+(1)
CALL MADD2(3,1,SHDCOR(1,1,I),+1.,VPI,-1.,VIPTSH(1,1,J))
41 CONTINUE

```

C COMPUTE THE DOUBLE AREA THAT THE POINT  
C OF INTERSECTION SUBTENDS AT THE SHAD-  
C OWER POLYGON.

```

A= 0.
DO 42 I=2,J
CALL VCRS(VIPTSH(1,1,I-1),VIPTSH(1,1,I),A00024)
A=(A)+(VMAG(A00024,3))
42 CONTINUE
CALL VCRS(VIPTSH(1,1,J),VIPTSH(1,1,1),A00025)
A=(A)+(VMAG(A00025,3))

```

C DETERMINE WHETHER THE POINT OF INTER-  
C SECTION LIES INSIDE OR OUTSIDE THE  
C SHADOWER POLYGON.

```

IF ((A)/(SHDAR(SH)),LE.(1.002))) GO TO 69
IT LIES OUTSIDE.

```

```

43 CONTINUE 28
C          THE OBSERVER IS NOT SHADOWED.
C          STARTING WITH SOURCE FS, CONSIDER A NEW
C          SOURCE.
44 DO 68 S=FS, NS 29
    IF ((FLUX(S)).EQ.((0.))) GO TO 68 30
C          DOES THE TARGET REFLECTOR ELEMENT FACE
C          IT.
    COSTH= VDOT(VUNT(1,1,R),VUTS(1,1,S),3) 31
    IF ((COSTH).LE.((0.))) GO TO 68
C          YES. IS SHADOWING CONSIDERED FOR THIS
C          SOURCE.
    IF ((SHADO).EQ.((0))) GO TO 55 32
    IF ((S)=2) 45,46,47
45 GO TO (48,55,48,55,48,55,48), SHADO
46 GO TO (55,48,48,55,55,48,48), SHADO
47 IF ((SHADO).LT.((4))) GO TO 55
C          YES. IS THE TARGET REFLECTOR ELEMENT
C          SHADOWED FROM THE SOURCE.
48 RAT1S=(VUTS(2,1,S))/(VUTS(1,1,S))
    RAT2S=(VUTS(3,1,S))/(VUTS(1,1,S))
    DO 54 K=1, NSH 33
    SH=(SHAD(K,SURF))
    IF ((SH).EQ.((0))) GO TO 55 34
C          DETERMINE THE POINT OF INTERSECTION
C          BETWEEN THE SHADOWER PLANE AND THE
C          SOURCE-REFLECTOR LINE.
    CORNF=(CORNER(SH)) 35
    IF ((VUTS(1,1,S)).NE.((0.))) GO TO 50
    IF ((VUTS(2,1,S)).NE.((0.))) GO TO 49
    IF ((ABS((VUNSHD(3,1,SH))).LE.((.00001))) GO TO 54
    VPI(1,1)=(VTE(1,1,R))
    VPI(2,1)=(VTE(2,1,R))
    VPI(3,1)=((VUNSHD(1,1,SH))*(SHDCOR(1,1,CORNF))-(VTE(1,1,R)))+(VUN
1SHD(2,1,SH))*(SHDCOR(2,1,CORNF))-(VTE(2,1,R)))+(VUNSHD(3,1,SH))*
2SHDCOR(3,1,CORNF))/(VUNSHD(3,1,SH))
    GO TO 51
49 COM3=(VUTS(3,1,S))/(VUTS(2,1,S))
    COM4=(VUNSHD(2,1,SH)+(VUNSHD(3,1,SH))*(COM3)
    IF ((ABS((COM4))).LE.((.00001))) GO TO 54
    VPI(1,1)=(VTE(1,1,R))
    VPI(2,1)=((VUNSHD(1,1,SH))*(SHDCOR(1,1,CORNF))-(VTE(1,1,R)))+(VUN
1SHD(2,1,SH))*(SHDCOR(2,1,CORNF))+(VUNSHD(3,1,SH))*((COM3)*(VTE(2,1
2,R)))+(SHDCOR(3,1,CORNF))-(VTE(3,1,R)))/(COM4)
    VPI(3,1)=(VTE(3,1,R)+(COM3)*((VPI(2,1))-(VTE(2,1,R))))
    GO TO 51
50 COM3=(VUNSHD(1,1,SH)+(RAT1S)*(VUNSHD(2,1,SH)+(RAT2S)*(VUNSHD(3,1
1,SH))
    IF ((ABS((COM3))).LE.((.00001))) GO TO 54
    VPI(1,1)=((VUNSHD(1,1,SH))*(SHDCOR(1,1,CORNF))+(VUNSHD(2,1,SH))*
1RAT1S*(VTE(1,1,R))-(VTE(2,1,R)))+(SHDCOR(2,1,CORNF)))+(VUNSHD(3,1,
2SH))*((RAT2S)*(VTE(1,1,R))-(VTE(3,1,R)))+(SHDCOR(3,1,CORNF)))/(COM
33)
    COM4=(VPI(1,1))-(VTE(1,1,R))
    VPI(2,1)=(RAT1S)*(COM4)+(VTE(2,1,R))

```



```

VPI(3,1)=(RAT2S)*(COM4)+(VTE(3,1,R))
C
C
C
51 CALL MADD2(3,1,VPI,+1.,VTE(1,1,R),-1.,A00026) 36
CALL UNIT(A00026,A00027,3)
IF (( VDOT(VUNT(1,1,R),A00027,3)).LE.((0.))) GO TO 54
C
C
C
YES. CONSTRUCT VECTORS FROM THE POINT
OF INTERSECTION TO THE CORNERS OF THE
SHADOWER POLYGON.
CORNL=(CORNER(SH+1))-(1) 37
J=(0)
DO 52 I=CORNF,CORNL
J=(J)+(1)
CALL MADD2(3,1,SHDCOR(1,1,I),+1.,VPI,-1.,VIPTSH(1,1,J))
52 CONTINUE
C
C
C
COMPUTE THE DOUBLE AREA THAT THE POINT
OF INTERSECTION SUBTENDS AT THE SHAD-
OWER POLYGON.
A= 0.
DO 53 I=2,J
CALL VCRS(VIPTSH(1,1,I-1),VIPTSH(1,1,I),A00028)
A=(A)+(VMAG(A00028,3))
53 CONTINUE
CALL VCRS(VIPTSH(1,1,J),VIPTSH(1,1,1),A00029)
A=(A)+(VMAG(A00029,3))
C
C
C
DETERMINE WHETHER THE POINT OF INTER-
SECTION LIES INSIDE OR OUTSIDE THE
SHADOWER POLYGON.
IF ((A)/(SHDAR(SH)).LE.((1.002))) GO TO 68
IT LIES OUTSIDE.
C
54 CONTINUE 38
C
C
THE SOURCE IS NOT SHADOWED.
INCREMENT REFLECTED LIGHT.
55 CALL VCRS(VUNT(1,1,R),VUOV,A00030) 39
CALL VCRS(VUNT(1,1,R),VUTS(1,1,S),A00031)
CALL UNIT(A00030,A00032,3)
CALL UNIT(A00031,A00033,3)
COSPHI= VDOT(A00032,A00033,3)
IF ((COSPHI).GT.((1.))) GO TO 56
GO TO 57
56 CONTINUE
COSPHI= 1.
57 CONTINUE
IF ((COSPHI).LT.(-(1.))) GO TO 58
GO TO 59
58 CONTINUE
COSPHI=- 1.
59 CONTINUE
PHIP=(RAD)*(ACOS((COSPHI)))
IF ((COSTH).GT.((1.))) GO TO 60
GO TO 61
60 CONTINUE
COSTH= 1.
61 CONTINUE
IF ((COSTH).LT.(-(1.))) GO TO 62

```

```

GO TO 63
62 CONTINUE
COSTH=- 1.
63 CONTINUE
THETA=(RAD)*(ACOS((COSTH)))
IF ((COSTHP).GT.((1.))) GO TO 64
GO TO 65
64 CONTINUE
COSTHP= 1.
65 CONTINUE
IF ((COSTHP).LT.(-(1.))) GO TO 66
GO TO 67
66 CONTINUE
COSTHP=- 1.
67 CONTINUE
THETAP=(RAD)*(ACOS((COSTHP)))
TOTAL=TOTAL+ (REFLEC((THETA),(THETAP),(PHIP),(MAT(SURF))))*(COSTH
1)*(COSTHP)*(RAREA(R))*(FLUX(S))
68 CONTINUE 40
69 CONTINUE 41
70 CONTINUE 42
C COMPUTE TOTAL REFLECTED VISIBLE LIGHT
E=(4.566932E24)/(VMAG(SPOS,3))** 2
B=(TOTAL)*(E)/(PI)* 621. / 10.76387 / (VMAG(VOV,3))**(2)
C SET VISIBILITY FLAG
71 VIS=(0) 43
IF ((FLUX(1)).GT.((0.))) GO TO 72
GO TO 73
72 CONTINUE
VIS=(VIS)+(1)
73 CONTINUE
IF ((FLUX(2)).GT.((0.))) GO TO 74
GO TO 75
74 CONTINUE
VIS=(VIS)+(2)
75 CONTINUE
IF ((NS).LT.((3))) GO TO 78
DO 76 I=3,NS
IF ((FLUX(I)).GT.((0.))) GO TO 77
76 CONTINUE
GO TO 78
77 VIS=(VIS)+(4)
78 RETURN 44
END

```

FUNCTION REFLEC(TH,THP,PHP,MAT)

C PROGRAM NO. 3960  
C PROGRAMMED BY J. W. GEANACOU, GENERAL DYNAMICS CONVAIR  
C WHERE TH IS THE ANGLE BETWEEN THE INCIDENT ENERGY RAY AND THE NORMAL TO  
C THE REFLECTING TARGET ELEMENT  
C THP IS THE ANGLE BETWEEN THE NORMAL TO THE TARGET ELEMENT AND THE  
C LINE BETWEEN THAT ELEMENT AND THE OBSERVER  
C PHP IS THE ANGLE BETWEEN THE TWO PLANES IN WHICH TH AND THP ARE  
C DETERMINED  
C MAT IS THE MATERIAL OR COATING CODE OF THE TARGET SURFACE

C THIS SUBROUTINE

C A. DETERMINES WHETHER A LOW DENSITY OR HI DENSITY GRID IS TO BE  
C INTERPOLATED TO.  
C B. DOUBLE LINEAR INTERPOLATES THP AND PHP TO APPROPRIATE BI DIRECTIONAL  
C REFLECTIVITY(UDR) TABLES WHICH CORRESPOND TO THE TWO THETAS WHICH BRACKE  
C TH  
C C. SINGLE LINEAR INTERPOLATES TH TO THE TWO UDRS OBTAINED IN STEP B.

C A COMMON THETA SET IS ASSUMED FOR LOW AND HIGH DENSITY TABLES  
C FOR ALL MATERIALS.  
C HIGH DENSITY TABLES ARE USED FOR SPECULAR VALUES OF TH,THP, AND PHP.  
C STORAGE FOR 6 DIFFERENT MATERIALS ARE PROVIDED FOR BOTH LOW AND HIGH  
C DENSITY TABLES.  
C ALL UDR FUNCTION STORAGE IS SINGLY DIMENSIONED, EVEN THOUGH STORAGE  
C CAN BE CONCEIVED, FOR THE LOW DENSITY UDR FUNCTION, AS TRIPLY DIMENSIONED  
C (PHIPRM X THTPRM X THETA OR M X N X K).  
C THIS SINGLE DIMENSION NOTATION ALLOWS THE USER TO CHANGE M X N X K  
C WITHOUT RECOMPILING THIS SUBROUTINE, UNLESS STORAGE IS EXCEEDED.

C PROCESSING IS SUCH THAT LOW DENSITY UDR TABLES ASSUME A COMMON GRID  
C OF PHI PRIME, THETA PRIME, THROUGH ALL THETAS AND MATERIALS.  
C HIGH DENSITY TABLE PROCESSING DOES NOT ASSUME THIS. THEREFORE BEGINNING  
C INDEXES CALLED BPHPH1, BTHPH1...ETC. FOR PHI PRIME, THETA PRIME FOR  
C EACH NEW THETA AND MATERIAL MUST BE MADE AVAILABLE, TO LOCATE THEIR  
C RELATIVE POSITION IN THE ARRAYS. BURFH1...ETC ARE THE FUNCTION INDEXES.

C BI-DIRECTIONAL REFLECTIVITY DATA IS OBTAINED FROM PROGRAM 3920

C STORAGE LIMITATIONS

C M MAXIMUM = 15  
C N MAXIMUM = 10  
C K MAXIMUM = 10

C LOW DENSITY UDR DIMENSION FOR EACH MATERIAL MAXIMUM(UDRLXX) MAY NOT EXCE  
C 1500.

C THE DIMENSION MAXIMUM FOR HIGH DENSITY UDR TABLES IS 90 FOR EACH MATERIA  
C THIS IS THE CUMULATIVE MAXIMUM FOR THE UDR TABLES THROUGH THE K THETAS.  
C ANY SINGLE HIGH DENSITY UDR TABLE CORRESPONDING TO A SINGLE THETA  
C HAS ROW AND COLUMN DIMENSIONS THAT MAY VARY AND ARE COMPUTED FROM THE  
C BPHPHX AND BTHPHX INDEXES.

C THE SUM OF THE PRODUCTS OF THESE HIGH DENSITY DIMENSIONS THROUGH

C K THETAS MAY NOT EXCEED 90 FOR A GIVEN MATERIAL.  
 C THE SUM OF THE UDR HIGH DENSITY ROW DIMENSIONS REPRESENTED BY PPHXX MAY  
 C NOT EXCEED 30 FOR A GIVEN MATERIAL.  
 C THE SUM OF THE UDR HIGH DENSITY COLUMN DIMENSIONS REPRESENTED BY THPHXX  
 C MAY NOT EXCEED 30 FOR A GIVEN MATERIAL.

C  
 C  
 C  
 C THETAS, LOW DENSITY THETA PRIMES AND PHI PRIMES, SPECULAR FLAGS AND M, N  
 C K ARE STORED VIA BLOCK DATA DECK RFL1.  
 C ALL LOW DENSITY UDR DATA IS STORED AS SETS BY PHI PRIME BY THETA PRIME  
 C BY MATERIAL VIA BLOCK DATA DECK RFL2.  
 C IF HIGH DENSITY DATA IS TO BE USED IT WILL HAVE TO BE PLACED IN  
 C ANOTHER BLOCK DATA PROGRAM UNDER NAMED COMMON RFTH1.  
 C IF THERE IS NO SPECULAR HIGH DENSITY TABLE FOR A GIVEN THETA AND  
 C MATERIAL ITS SPECULAR FLAG(SPECF) MUST BY INITIALIZED TO ZERO.  
 C IF THE UDR DATA IS SPECULAR THE SPECF FLAG MUST BE NON-ZERO.  
 C IF A NON SPECULAR UDR SET IMMEDIATELY FOLLOWS A SPECULAR UDR SET  
 C A SYNTHETIC BEGINNING INDEX FOR PHI PRIME AND THETA PRIME EQUAL  
 C TO THE RELATIVE STORAGE LOCATIONS PLUS 1 OF THE ENDS OF THE IMMEDIATELY  
 C PRECEDING HIGH DENSITY PHI PRIME AND THETA PRIME MUST BE INITIALIZED.

```
COMMON/RFTLOW/UDRL01(1500),UDRL02(1500),UDRL03(1500),UDRL04(1500),
*UDRL05(1500),UDRL06(1500),
*THETA(10),THTPRM(10),PHIPRM(15), SPECF(60).
```

```
*M,N,K
```

```
COMMON/RFTH1/UDRH01(90),UDRH02(90),UDRH03(90),UDRH04(90),UDRH05(90
*),UDRH06(90),
```

```
*PHPH01(30),PHPH02(30),PHPH03(30),PHPH04(30),PHPH05(30),PHPH06(30),
*THPH01(30),THPH02(30),THPH03(30),THPH04(30),THPH05(30),THPH06(30),
*BPHPH1(11),BPHPH2(11),BPHPH3(11),BPHPH4(11),BPHPH5(11),BPHPH6(11),
*BTHPH1(11),BTHPH2(11),BTHPH3(11),BTHPH4(11),BTHPH5(11),BTHPH6(11),
*BURFH1(10),BURFH2(10),BURFH3(10),BURFH4(10),BURFH5(10),BURFH6(10)
```

```
DIMENSION UDRLM(2)
```

```
INTEGER SPECF,BPHPH1,BPHPH2,BPHPH3,BPHPH4,BPHPH5,BPHPH6,BTHPH1,BTH
*PH2,BTHPH3,BTHPH4,BTHPH5,BTHPH6,BURFH1,BURFH2,BURFH3,BURFH4,BURFH5
,BURFH6
```

```
C SEARCH THETA TABLE
```

```
DO 100 I=2,K
```

```
IF(TH.LE.THETA(I)) GO TO 150
```

```
100 CONTINUE
```

```
I=K
```

```
150 I=I-1
```

```
IL=1
```

```
C COMPUTE SUBSCRIPT TO LOW DENSITY UDR TABLE(ROWS*COLUMNS*(I-1)+1)
```

```
175 JJJ=M*N*(I-1)+1
```

```
C CHECK IF THETA(I) TABLE HAS SPECULAR LIMITS FOR MATERIAL MAT
```

```
C FIRST USE MATERIAL CODE TO COMPUTE SPECULAR FLAG SUBSCRIPT
```

```
C K IS THE NO. OF THETAS COMMON TO ALL TABLES
```

```
ISF = I+(MAT-1)*K
```

```
GO TO(200,210,220,230,240,250),MAT
```

```
200 IF(SPECF(ISF).EQ.0) GO TO 400
```

```
C MATERIAL I HAS SPECULAR LIMITS
```

```
C COMPUTE STARTING AND ENDING SUBSCRIPTS FOR PHIPRIME AND THETAPRIME
```

```
C HIGH DENSITY TABLES
```

```

JP=BPHPH1(I)
JT= BTHPH1(I)
MH=BPHPH1(I+1)-1
NH=BTHPH1(I+1)-1
C CHECK IF ARGUMENTS ARE WITHIN LIMITS
  IF (THP.GT.THPH01(JT).AND.TH.P.LT.THPH01(NH).AND.PHP.GT.PHPH01(JP) .
*AND.PHP.LT.PHPH01(MH)) GO TO 700
C NOT WITHIN LIMITS FOR THIS MATERIAL. USE LOW DENSITY TABLE FOR THIS MATERIAL
  GO TO 400
210 IF (SPECF (ISF).EQ.0) GO TO 410
  JP=BPHPH2(I)
  JT =BTHPH2(I)
  MH=BPHPH2(I+1)-1
  NH=BTHPH2(I+1)-1
  IF (THP.GT.THPH02(JT).AND.TH.P.LT.THPH02(NH).AND.PHP.GT.PHPH02(JP) .
*AND.PHP.LT.PHPH02(MH)) GO TO 710
  GO TO 410
220 IF (SPECF (ISF).EQ.0) GO TO 420
  JP=BPHPH3(I)
  JT =BTHPH3(I)
  MH=BPHPH3(I+1)-1
  NH=BTHPH3(I+1)-1
  IF (THP.GT.THPH03(JT).AND.TH.P.LT.THPH03(NH).AND.PHP.GT.PHPH03(JP)
*.AND.PHP.LT.PHPH03(MH))GO TO 720
  GO TO 420
230 IF (SPECF (ISF).EQ.0) GO TO 430
  JP=BPHPH4(I)
  JT=BTHPH4(I)
  MH=BPHPH4(I+1)-1
  NH=BTHPH4(I+1)-1
  IF (THP.GT.THPH04(JT).AND.TH.P.LT.THPH04(NH).AND.PHP.GT.PHPH04(JP)
*.AND.PHP.LT.PHPH04(MH)) GO TO 730
  GO TO 430
240 IF (SPECF (ISF).EQ.0) GO TO 440
  JP=BPHPH5(I)
  JT=BTHPH5(I)
  MH=BPHPH5(I+1)-1
  NH=BTHPH5(I+1)-1
  IF (THP.GT.THPH05(JT).AND.TH.P.LT. THPH05(NH).AND.PHP.GT.PHPH05(JP)
*.AND.PHP.LT.PHPH05(MH)) GO TO 740
  GO TO 440
250 IF (SPECF (ISF).EQ.0) GO TO 450
  JP=BPHPH6(I)
  JT=BTHPH6(I)
  MH=BPHPH6(I+1)-1
  NH=BTHPH6(I+1)-1
  IF (THP.GT.THPH06(JT).AND.TH.P.LT. THPH06(NH).AND.PHP.GT.PHPH06(JP)
*.AND.PHP.LT.PHPH06(MH)) GO TO 750
  GO TO 450
C
C LOW DENSITY TABLES DOUBLE LINEAR INTERPOLATION
400 UDRLM(IL)=DTABLU(PHP,THP,PHIPRM,THTPRM,UDRL01(JJJ),M,N)
  GO TO 900
410 UDRLM(IL)=DTABLU(PHP,THP,PHIPRM,THTPRM,UDRL02(JJJ),M,N)
  GO TO 900

```

```

420 UDRLM(IL)=DTABLU(PHP,THP,PHIPRM,THTPRM,UDRL03(JJJ),M,N)
GO TO 900
430 UDRLM(IL)=DTABLU(PHP,THP,PHIPRM,THTPRM,UDRL04(JJJ),M,N)
GO TO 900
440 UDRLM(IL)=DTABLU(PHP,THP,PHIPRM,THTPRM,UDRL05(JJJ),M,N)
GO TO 900
450 UDRLM(IL)=DTABLU(PHP,THP,PHIPRM,THTPRM,UDRL06(JJJ),M,N)
GO TO 900
C
C HIGH DENSITY TABLES DOUBLE LINEAR INTERPOLATION
C COMPUTE BEGINNING SUBSCRIPT FOR UDR HIGH DENSITY TABLE
C AND DIMENSIONS
700 MS=BURFH1(I)
MH=MH-JP+1
NH=NH-JT+1
UDRLM(IL)=DTABLU(PHP,THP,PHPH01(JP),THPH01(JT),UDRH01(MS),MH,NH)
GO TO 900
710 MS=BURFH2(I)
MH=MH-JP+1
NH=NH-JT+1
UDRLM(IL)=DTABLU(PHP,THP,PHPH02(JP),THPH02(JT),UDRH02(MS),MH,NH)
GO TO 900
720 MS=BURFH3(I)
MH=MH-JP+1
NH=NH-JT+1
UDRLM(IL)=DTABLU(PHP,THP,PHPH03(JP),THPH03(JT),UDRH03(MS),MH,NH)
GO TO 900
730 MS=BURFH4(I)
MH=MH-JP+1
NH=NH-JT+1
UDRLM(IL)=DTABLU(PHP,THP,PHPH04(JP),THPH04(JT),UDRH04(MS),MH,NH)
GO TO 900
740 MS=BURFH5(I)
MH=MH-JP+1
NH=NH-JT+1
UDRLM(IL)=DTABLU(PHP,THP,PHPH05(JP),THPH05(JT),UDRH05(MS),MH,NH)
GO TO 900
750 MS=BURFH6(I)
MH=MH-JP+1
NH=NH-JT+1
UDRLM(IL)=DTABLU(PHP,THP,PHPH06(JP),THPH06(JT),UDRH06(MS),MH,NH)
900 IF(IL.EQ.1) GO TO 950
C SINGLE LINEAR INTERPOLATE THETA ARGUMENT AFTER UDR FOR ADJACENT THETAS
C HAS BEEN COMPUTED
REFLEC=TABLU(TH,THETA(I=1),UDRLM,2)
RETURN
C LOWER ADJACENT THETA LOGIC COMPLETE. DO LOGIC FOR UPPER ADJACENT THETA.
950 I=I+1
IL=IL+1
GO TO 175
END

```

```

REAL FUNCTION JPLLRM(A,B)
C PROGRAMMED BY J. W. GEANACOU, GENERAL DYNAMICS CONVAIR
C- DOUBLE LINEAR INTERPOLATION
C-TWO INDEPENDENT VARIABLES A AND B ARE LINEARLY INTERPOLATED TO Y AND X
C ,RESPECTIVELY, TO OBTAIN Z
C-A IS THE Y INPUT VALUE.
C-B IS THE X INPUT VALUE.
C-X IS THE LOCATION OF THE X VALUES IN THE TABLE(TAU  ANGLES IN LUNAR
C REFLECTIVITY MODEL)
C-Y IS THE LOCATION OF THE Y VALUES IN THE TABLE(ALPHA, THE PHASE ANGLES IN
C THE LUNAR REFLECTIVITY MODEL)
C-Z IS THE LOCATION OF THE Z VALUES IN THE TABLE(PHOFUN, THE LUNAR
C REFLECTIVITY FUNCTION)
C-NX IS THE NUMBER OF ROWS OF THE Z TABLE(=NUMBER OF X TABLE VALUES)
C-NY IS THE NUMBER OF COLUMNS OF THE Z TABLE(= NUMBER OF Y TABLE VALUES)
C INPUT VARIABLES OUT OF TABLE LIMITS ARE SET TO TABLE LIMITS
  DIMENSION X(9),Y(19),Z(9,19)
  DATA (X=-80.,-60.,-40.,-20.,0.,20.,40.,60.,80.)
  DATA (Y=0.,5.,10.,15.,20.,30.,40.,50.,60.,70.,80.,90.,100.,110.,
1120.,130.,140.,150.,160.)
  DATA (Z=9(.09),3(.07),.0702,.0704,.0694,.067,.061,.0418,.0585,
A2(.0584),.0585,.0576,.0551,.0493,.0387,0.,.0518,.0516,.0514,.0513,
B,.0508,.0473,.0395,.025,0.,2(.0466),.0463,.0461,.0454,.0410,.0315,
C,.0139,0.,.0404,.04,.0392,.0381,.0358,.0304,.0196,2(0.),.035,.0344,
D,.0333,.0314,.0281,.0217,.0089,2(0.),.0313,.0301,.0284,.0255,.0214,
E,.0139,3(0.),.0276,.0264,.0241,.0206,.0149,.0066,3(0.),.025,.0231,
F,.0204,.016,.0096,4(0.),.0225,.0203,.0167,.0118,.0045,4(0.),.02,
G,.0169,.0131,.0076,5(0.),.0172,.0141,.01,.0039,5(0.),.0146,.0113,
H,.0066,6(0.),.0122,.0085,.0032,6(0.),.0099,.0056,7(0.),.0074,.0026,
I7(0.),.0047,8(0.),.0024,8(0.))
  C=A
  D=B
  DO 5 I=1,9
  IF(I.EQ.1.AND.D.LT.X(I))GO TO 7
  IF(D-X(I))10, 8,5
5 CONTINUE
  I=9
C SET TO UPPER OR LOWER LIMIT IF OUTSIDE LIMIT
  7 D=X(I)
  8 IF(I.NE.1)GO TO 10
  NX1=I
  NX2=I+1
  GO TO 14
10 NX1=I-1
  NX2=I
14 DO 15 I=1,19
  IF(I.EQ.1.AND.C.LT.Y(I))GO TO 17
  IF(C-Y(I))20,18,15
15 CONTINUE
  I=19
C SET TO UPPER OR LOWER LIMIT IF OUTSIDE LIMIT
17 C=Y(I)
18 IF(I.NE.1)GO TO 20
  NY1=I
  NY2=I+1

```

```
GO TO 25
20 NY1=I-1
   NY2=I
25 RATIO=(D-X(NX1))/(X(NX2)-X(NX1))
   TEM1=Z(NX1,NY1)*(1.-RATIO)+Z(NX2,NY1)*RATIO
   TEM2=Z(NX1,NY2)*(1.-RATIO)+Z(NX2,NY2)*RATIO
   RATIO=(C-Y(NY1))/(Y(NY2)-Y(NY1))
   JPLLRM =TEM1*(1.-RATIO)+TEM2*RATIO
RETURN
END
```



```
C    FUNCTION VMAG(V,N)
      COMPUTES THE MAGNITUDE OF A VECTOR
      DIMENSION V(N)
      VM=0.
      DO 5 I=1,N
5     VM=VM+V(I)**2
      VMAG=SQRT(VM)
      RETURN
      END
```

```
SUBROUTINE MTMPY (A,B,C,L,M,N)
DIMENSION A(L,M),B(M,N),C(L,N)
DO 1 I=1,N
DO 1 J=1,L
C(J,I)=0.
DO 1 K=1,M
1 C(J,I)=C(J,I)+A(J,K)*B(K,I)
RETURN
END
```

```
SUBROUTINE TRS (A,B,M,N)
DIMENSION A(M,N),B(N,M)
DO 1 I=1,N
DO 1 J=1,M
1 B(I,J)=A(J,I)
RETURN
END
```

SUBROUTINE VCRS(A,B,Z)

C CROSS PRODUCT  
C TWO VECTORS A AND B ARE INPUT. THEIR  
C CROSS PRODUCT (A CROSS B) IS COMPUTED  
C AND THE RESULTING VECTOR IS OUTPUT  
C IN Z.

DIMENSION A(3),B(3),Z(3)

Z(1)=A(2)\*B(3)-B(2)\*A(3)

Z(2)=B(1)\*A(3)-A(1)\*B(3)

Z(3)=A(1)\*B(2)-B(1)\*A(2)

RETURN

END

1  
2  
3  
4

```
      SUBROUTINE UNIT(A,Z,N)
C     FORMS A UNIT VECTOR
C     THE VECTOR A IS INPUT AND THE OUTPUT
C     VECTOR Z IS THE UNIT VECTOR A
      DIMENSION A(N),Z(N)
      X=VMAG(A,N)
      DO 1 J=1,N
1     Z(J)=A(J)/X
      RETURN
      END
```

1  
2

```
FUNCTION VDOT(A,B,N)
C DOT PRODUCT
C THE INPUT ARGUMENTS ARE THE VECTORS(N-DIMENSIONAL)
C A AND B. THE DOT PRODUCT (A DOT B)
C IS COMPUTED.
  DIMENSION A(N),B(N)
  VDOT=0.
  DO 1 J=1,N
1 VDOT=A(J)*B(J)+VDOT
  RETURN
  END
```

```
SUBROUTINE MADD1(NROW,NCOL,A,S1,C)
DIMENSION A(NROW,NCOL),C(NROW,NCOL)
DO 1 I=1,NCOL
DO 1 J=1,NROW
1 C(J,I)=S1*A(J,I)
RETURN
END
```

```
SUBROUTINE MADD2(NROW,NCOL,A,S1,B,S2,C)
DIMENSION A(NROW,NCOL),B(NROW,NCOL),C(NROW,NCOL)
DO 1 I=1,NCOL
DO 1 J=1,NROW
1 C(J,I)=S1*A(J,I)+S2*B(J,I)
RETURN
END
```



## SECTION 7

### REFERENCES

1. Visibility Program Interface Description, C. Manry, Manned Spacecraft Center, Aug 1965.  
NOTE: An Annotated copy included as APPENDIX A.
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5. The Scientific Basis of Illuminating Engineering, Parry Moon, Dover revised edition 1961.
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APPENDIX A

AN ANNOTATED COPY OF

VISIBILITY PROGRAM INTERFACE DESCRIPTION

The following information is to define the interface between the existing NASA "LEM Visibility Program" and the proposal for "Visual Detection of Objects in the Space Environment" (a revision to Convair's proposal GDA-DBE64-070).

Reference Frame:

The inertial reference frame is selenocentric with respective axes parallel to a geocentric system defined by the mean equator and the ecliptic at the nearest beginning of a besselian year. The X axis is in the direction of the vernal equinox, the Z axis along the mean pole, and the Y axis to form a right-handed orthogonal system. All position and velocity data are referenced to this system (Figure 1).

Units:

The cartesian coordinates of the earth and sun are measured in earth radii (1 E.R. = 3963.20006 US statute miles). The cartesian coordinates of the LEM and CSM are measured in feet and velocities in ft/sec.

TP $\phi$ S(1) = X component of target vehicle  
TP $\phi$ S(2) = Y component of target vehicle  
TP $\phi$ S(3) = Z component of target vehicle

TATT(1) = angular rotation about target X axis  
TATT(2) = angular rotation about target Y axis(1)  
TATT(3) = angular rotation about target Z axis

Illum = intensity of reflected light computed in subroutine GDA.

Photometric Function Subroutine:

The subroutine<sup>(2)</sup> to compute the photometric function is called as follows:

CALL JPLLRM (I, EP<sup>(3)</sup>, PH $\phi$ FUN)

where:

I = angle between source and surface normal  
EP = angle between normal and viewing line  
Phofun = photometric function (Figure 2)<sup>(4)</sup>

Body Attitudes:

All angular rotations are measured in radians. When all angular rotations are zero, the body axes are respectively parallel to the inertial axes.

Subroutine "GDA":

The calling sequence of the subroutine, written by General Dynamics Convair, should be of the following form:

CALL GDA (SP $\phi$ S, EP $\phi$ S, TP $\phi$ S, TATT, ILLUM)<sup>(5)</sup>

where:

SP $\phi$ S(1) = X component of sun  
SP $\phi$ S(2) = Y component of sun  
SP $\phi$ S(3) = Z component of sun

EP $\phi$ S(1) = X component of earth  
EP $\phi$ S(2) = Y component of earth  
EP $\phi$ S(3) = Z component of earth

NOTES:

- (1) TATT<sub>(1)</sub>, TATT<sub>(2)</sub>, TATT<sub>(3)</sub>, are defined as yaw, pitch and roll in that order as defined in Section 2.7.
- (2) A subroutine was not supplied - rather NASA/MSC supplied the photometric function (tabular form of figure 4) for direct use by the TDM as a double table look-up.
- (3) Arguments used by table look-up are  $\alpha$  and  $\tau$  not I and EP.
- (4) The photometric function is used in the manner of equation (8) to compute luminosity.
- (5) The vector  $\phi$ P $\phi$ S (observer position) was added here.