

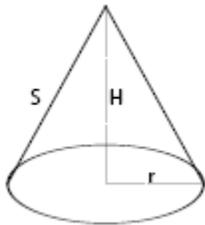
CHAPTER 25  
Calculations and Reports

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**Rev 11/09**

**DOCUMENTATION MANUAL  
SECTION A  
VOLUME CALCULATIONS  
(WHEN MEASUREMENTS ARE IN ENGLISH)**

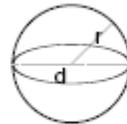
The following illustrations are to assist in keeping calculations simple. This page shows different equations for calculating volume when the UOM is in English. If there are any questions please call Headquarters Construction.



Volume of a Cone

$$\text{CUFT} = 1/3 \pi r^2 H$$

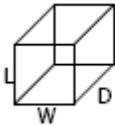
$$\text{CUYD} = [1/3 \pi r^2 H] / 27$$



Volume of a Sphere

$$\text{CUFT} = 4/3 \times \pi r^3$$

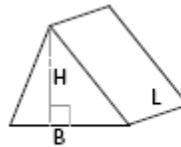
$$\text{CUYD} = (4/3 \times \pi r^3) / 27$$



Volume of a Cube

$$\text{CUFT} = L \times W \times D$$

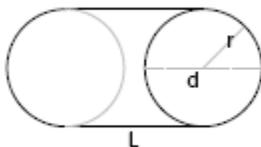
$$\text{CUYD} = (L \times W \times D) / 27$$



Volume of a Triangle

$$\text{CUFT} = 1/2 (B \times H \times L)$$

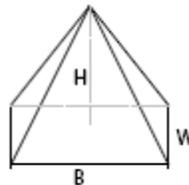
$$\text{CUYD} = [1/2(B \times H \times L)] / 27$$



Volume of a Cylinder / Pipe

$$\text{CUFT} = \pi r^2 \times L$$

$$\text{CUYD} = (\pi r^2 \times L) / 27$$



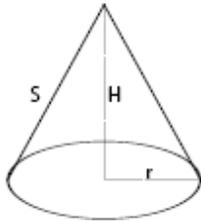
Volume of a Pyramid

$$\text{CUFT} = 1/3 (B \times W \times H)$$

$$\text{CUYD} = [1/3 (B \times W \times H)] / 27$$

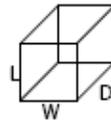
## VOLUME CALCULATIONS (WHEN MEASUREMENTS ARE IN METRIC)

The following illustrations are to assist in keeping calculations simple. This page shows different equations for calculating volume when the UOM is in Metric. If there are any questions please call Headquarters Construction.



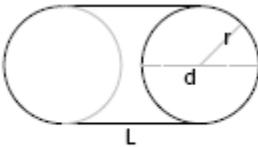
Volume of a Cone

$$\text{CUM} = 1/3 \pi r^2 H$$



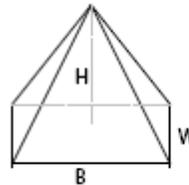
Volume of a Cube

$$\text{CUM} = L \times W \times D$$



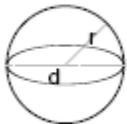
Volume of a Cylinder / Pipe

$$\text{CUM} = \pi r^2 \times L$$



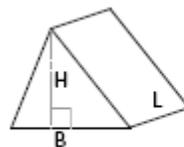
Volume of a Pyramid

$$\text{CUM} = 1/3 (B \times W \times H)$$



Volume of a Sphere

$$\text{CUM} = 4/3 \times \pi r^3$$

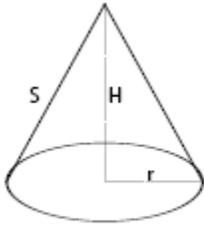


Volume of a Triangle

$$\text{CUM} = 1/2 (B \times H \times L)$$

**DOCUMENTATION MANUAL**  
**SECTION B**  
**AREA CALCULATIONS**  
**(WHEN MEASUREMENTS ARE IN ENGLISH)**

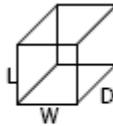
The following illustrations are to assist in keeping calculations simple. This page shows different equations for calculating area when the UOM is in English. If there are any questions please call Headquarters Construction.



Area of a Cone

Surface Area (SQFT)=  
 $(\pi r S) + (\pi r^2)$

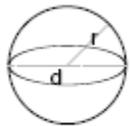
Surface Area (SQYD)=  
 $[(\pi r S) + (\pi r^2)] / 9$



Area of a Cube

Surface Area SQFT =  
 $(L \times W \times 2) + (L \times D \times 4)$

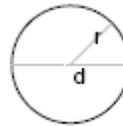
Surface Area SQYD =  
 $[(L \times W \times 2) + (L \times D \times 4)] / 9$



Area of a Sphere

Surface Area (SQFT) =  $4 \pi r^2$

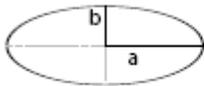
Surface Area (SQYD) =  $(4 \pi r^2) / 9$



Area of a Circle

SQFT =  $\pi r^2$

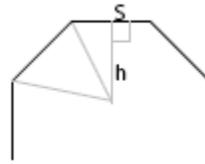
SQYD =  $\pi r^2 / 9$



Area of an Ellipse

SQFT =  $\pi a b$

SQYD =  $(\pi a b) / 9$

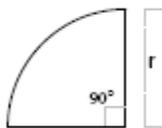


Area of a Polygons

SQFT =  $1/2 (N h S)$

SQYD =  $[1/2 (N h S)] / 9$

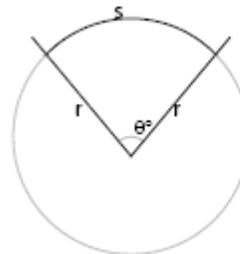
N = number of sides



Area of a Quadrant

SQFT =  $\frac{\pi r^2}{4}$

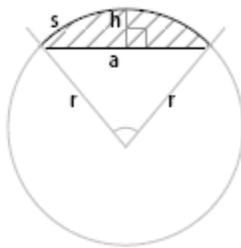
SQYD =  $[\frac{\pi r^2}{4}] / 9$



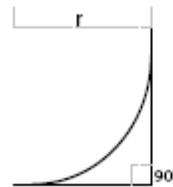
Sector of a Circle

SQFT =  $1/2 (\frac{\theta \pi}{180}) r^2$

SQYD =  $[1/2 (\frac{\theta \pi}{180}) r^2] / 9$



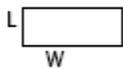
Segment of a Circle  
 SQFT =  $1/2 [s r - a (r - h)]$   
 SQYD =  $1/2 [s r - a (r - h)] / 9$



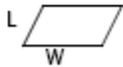
Area of a Spandrel  
 SQFT =  $0.2146 r^2$   
 SQYD =  $(0.2146 r^2) / 9$



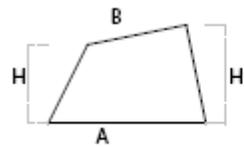
Area of a Square,  
 Rectangle and  
 Parallelogram



SQFT =  $L \times W$



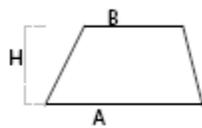
SQYD =  $L \times W / 9$



Area of a Trapezium

SQFT =  $\frac{(H + H1) \times (A + B)}{2}$

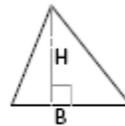
SQYD =  $\left[ \frac{(H + H1) \times (A + B)}{2} \right] / 9$



Area of a Trapezoid

SQFT =  $1/2 H \times (A + B)$

SQYD =  $[1/2 H \times (A + B)] / 9$



Area of a Triangle

SQFT =  $1/2 (B \times H)$

SQYD =  $[1/2 (B \times H)] / 9$

Proration: Example: Pipe plan = 40 linft

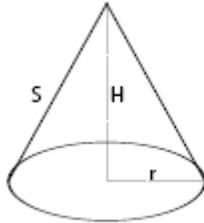
Pipe field measure = 45 linft

Structure Excavation plan = 120 cuyd

$45 \div 40 = 1.125 \times 120 = 135$  cuyd new quantity for structure excavation

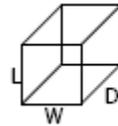
## AREA CALCULATIONS (WHEN MEASUREMENTS ARE IN METRIC)

The following illustrations are to assist in keeping calculations simple. This page shows different equations for calculating area when the UOM is in Metric. If there are any questions please call Headquarters Construction.



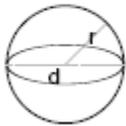
Area of a Cone

$$\text{Surface Area (SQM)} = (\pi r S) + (\pi r^2)$$



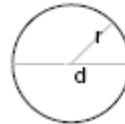
Area of a Cube

$$\text{Surface Area SQM} = (L \times W \times 2) + (L \times D \times 4)$$



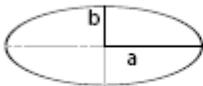
Area of a Sphere

$$\text{Surface Area (SQM)} = 4 \pi r^2$$



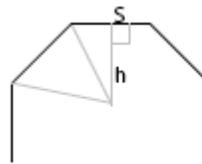
Area of a Circle

$$\text{SQM} = \pi r^2$$



Area of an Ellipse

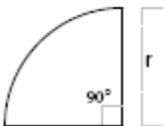
$$\text{SQM} = \pi a b$$



Area of a Polygons

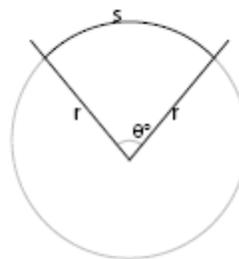
$$\text{SQM} = 1/2 (N h S)$$

N = number of sides



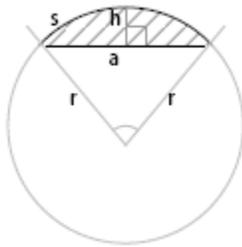
Area of a Quadrant

$$\text{SQM} = \frac{\pi r^2}{4}$$



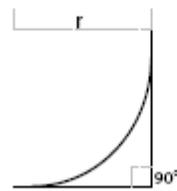
Sector of a Circle

$$\text{SQM} = 1/2 \left( \frac{\theta \pi}{180} \right) r^2$$



Segment of a Circle

$$SQM = 1/2 [s r - a (r - h)]$$

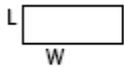


Area of a Spandrel

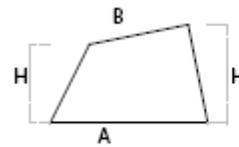
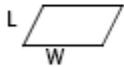
$$SQM = 0.2146 r^2$$



Area of a Square,  
Rectangle and  
Parallelogram

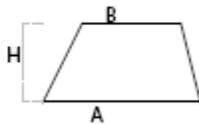


$$SQM = L \times W$$



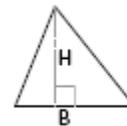
Area of a Trapezium

$$SQM = \frac{(H + H_1)}{2} \times \frac{(A + B)}{2}$$



Area of a Trapezoid

$$SQM = 1/2 H \times (A + B)$$



Area of a Triangle

$$SQM = 1/2 (B \times H)$$

**DOCUMENTATION MANUAL  
SECTION C  
WEEKLY NDOT CONSTRUCTION SITE DISCHARGE INSPECTION CHECKLIST**

Environmental requirements regarding storm water discharge from construction sites/projects have been changing recently. To address these changes, NDOT has developed Storm Water Quality Manuals (Construction Site “Best Management Practices” (BMP’s) Manual Planning and Design Guide). A Field Manual has also been developed for quick inspection reference. NDOT Environmental or NDOT Constructability will be handling the training and distribution of this manual.

The WEEKLY NDOT CONSTRUCTION SITE DISCHARGE INSPECTION CHECKLIST (Form No. 040-054) is to be completed on a weekly basis and turned into the field office to be distributed according to the bottom of the form. The Storm Water Permits are not required on all NDOT projects. Therefore, Projects that are identified as “No Impact” in Subsection 637.01.01 General, of the Special Provisions, will **NOT** require form 040-054 to be completed or distributed. This form shall be completed from the Notice to Proceed date through the final working day, including any job suspensions. The WEEKLY NDOT CONSTRUCTION SITE DISCHARGE INSPECTION CHECKLIST (Form No. 040-054) is available in the Stockroom.

The files for the WEEKLY NDOT CONSTRUCTION SITE DISCHARGE INSPECTION CHECKLIST shall be filed in Section 1-Contract Files, Division No. 19 as described in Chapter 1 (Organization of Project).

**Forms change periodically, please assure that you are using the most current form available, see Chapter 26 (Distribution of Documents).**

**DOCUMENTATION MANUAL  
SECTION D  
WORK ZONE TRAFFIC CONTROL CHECKLIST**

The Contractor's traffic control supervisor must complete a WORK ZONE TRAFFIC CONTROL CHECKLIST.

The traffic control supervisor shall make a record of each traffic control inspection using the WORK ZONE TRAFFIC CONTROL CHECKLIST (Form No. 040-056B). Each review shall include traffic control activities, the time the traffic control supervisor reviewed the traffic control, any actions taken, and any other pertinent information.

The traffic control supervisor shall be capable of being on-site within 45 minutes of notification. The traffic control supervisor shall make at least four (4) inspections of all traffic control devices each day as follows:

Before beginning work

At mid-shift

Half an hour after the end of the shift

A minimum of once during the period of non-working hours. The time between inspections shall not exceed 12 hours.

The WORK ZONE TRAFFIC CONTROL CHECKLIST (Form No. 040-056B) shall be submitted within twenty-four (24) hours to the NDOT field office and distributed according to the bottom of the form. The WORK ZONE TRAFFIC CONTROL CHECKLIST (Form No. 040-056B) can be obtained from the stockroom.

If the traffic control devices are paid as a lump sum item, make sure a current WORK ZONE TRAFFIC CONTROL CHECKLIST is on file before payment is made.

The files for the WORK ZONE TRAFFIC CONTROL CHECKLIST shall be filed in Section 1-Contract Files, Division No. 15 as described in Chapter 1 (Organization of Project).

**Forms change periodically, please assure that you are using the most current form available, see Chapter 26 (Distribution of Documents).**

**DOCUMENTATION MANUAL  
SECTION E  
SAFETY INSPECTION CHECKLIST-CONTRACTOR OPERATIONS**

The SAFETY INSPECTION CHECKLIST has been developed to aid in monitoring safety conditions on the project. The SAFETY INSPECTION CHECKLIST (Form No. 040-028) can be obtained from the stockroom.

This SAFETY INSPECTION CHECKLIST must be completed at least once for each project and turned into the NDOT field office to be distributed according to the bottom of the form. On contracts of long duration, the checklist must be submitted during each phase of the construction and at least quarterly.

The files for the SAFETY INSPECTION CHECKLIST-CONTRACTOR OPERATIONS shall be filed in Section 1-Contract Files, Division No. 19 as described in Chapter 1 (Organization of Project).

**Forms change periodically, please assure that you are using the most current form available, see Chapter 26 (Distribution of Documents).**

**DOCUMENTATION MANUAL  
SECTION F  
DAILY BIOLOGICAL FIELD REPORT**

The Department of Fish and Wildlife submits a Biological Opinion at the start of a contract to NDOT Environmental Services.

NDOT Environmental Services presents this opinion to the Contractor at the Pre-construction meeting.

During the course of the contract as outlined in the Biological Opinion, the Biologist shall submit daily a DAILY BIOLOGICAL FIELD REPORT to the NDOT field office and distributed according to the bottom of the form.

The original DAILY BIOLOGICAL FIELD REPORT shall be submitted to NDOT Environmental Services within twenty four (24) hours. The report shall be sent via E-mail, fax, or mail. Any questions call NDOT's Senior Biologist.

The DAILY BIOLOGICAL FIELD REPORT (Form No. 040-088) can be obtained from the stockroom.

The files for the **DAILY BIOLOGICAL FIELD REPORT** shall be filed in Section 1-Contract Files, Division No. 15 as described in Chapter 1 (Organization of Project).

**Forms change periodically, please assure that you are using the most current form available, see Chapter 26 (Distribution of Documents).**

**Rev 11/09**