Tennessee Archives Management Advisory

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ARCHIVAL CONTAINERS: TABLES OF CUBIC-FOOT EQUIVALENTS FOR CONTAINERS, SHELVING, AND CABINETRY COMMONLY FOUND IN ARCHIVES

Introduction. The bulk or volume of material in archives is an important element of planning and reporting the amount of material that is accountable, usable, stored for preservation, and retrieved for use. It is also important to planning the construction of new facilities. Converting common containers to useful measures for planning and reporting is necessary to archives management. This handbook offers some close approximations to practical conversion factors.

Metric versus Traditional Measures. Traditional English measures are used throughout instead of metric measures.[1]

Linear Shelf Feet versus Cubic Feet. When not measuring their holdings in numbers of unique titles, librarians conventionally measure their holdings in linear feet of standard-width shelving occupied by their books. For archivists, the "reportable unit" of holdings is usually the record group or "collection". Archivists sometimes also use linear feet for reporting the amount of shelving used or needed, but they more commonly use cubic feet because of the variable volume of archival containers and the variable size of shelving required.

A standard rule of thumb is to make a one-to-one equivalent between cubic feet and linear shelf feet to calculate the linear footage of standard-size shelving that is required to hold any body of records. However, this works well for only one type of container, the standard "records center carton", which contains one cubic foot of papers. Though it works tolerably well for the legal-size standard document cases (often called by the trade name of "Hollinger Box"), it does not do so well for letter-size cases, half-boxes, and flat cases, and not at all for magnetic tape boxes or motion-picture film cans.
In the following tables, for each container, the cubic footage (volume in cubic feet) is first calculated, and where appropriate, an equivalent linear shelf footage is also

provided, based on how much of a shelf the container's "footprint" occupies.

Calculations of Cubic Footage (Volume in Cubic Feet). Cubic foot equivalents offered here are calculated somewhat generously in rounding off numbers. They are used to calculate gross space occupancy and gross storage space needs, and they are not precise. Volumes in cubic feet (width times height times depth; *w* x *h* x *d* as containers are seen from the shelf face) [2] are from measured dimensions in inches, converted to fractions of feet for the calculation.

They are

- rounded off up to the nearest five one-hundredths of a cubic foot if the calculated volume is at X **.** X20 or greater;
- and down to the nearest five hundredth if at X **.** X19 or less;
- unless the result is less than 0.05 cubic foot, in which case the actual calculated volume is used.

For example:

- if the measured calculation produces a volume of 1.81 cubic feet, the nominal space occupancy is reckoned as 1.80 cubic feet; but,
- if the result is 1.82, then it is rounded off upwards to 1.85; and,
- if the calculated volume is only 0.02 cubic foot, it is so entered in the table.

This may differ slightly (by from 1 to 5 hundredths of a cubic foot) from standards that readers are accustomed to, but after some use, the new figures will become as familiar as the old. The adjustment is the price to pay for having a comprehensive table of equivalents. Moreover, with error very slightly on the side of over-estimation, these measures should produce ample space calculations for planning.

Container Capacity. In some cases, the nominal capacity of a container in terms of its more common item contents (pages, sheets, film frames, cards, etc.) may be given.

Ratio of Cubic Footage of Holdings to Square Footage of Storage Space

Builders commonly deal in square footage when planning and calculating the construction cost of a building or space within a building. Archivists and records managers must make a reasonable estimate of the size of the floor area they will need for the stacks (shelving) to accommodate their records. Since there are different kinds of shelving for different kinds of records (e.g. roller shelves for large, bound registers and flat metal shelving for boxed records), and since shelving may be of different heights,[3] depending on ceiling clearance and tolerable accessibility, the ratio of floor space to cubic footage of holdings stored will vary widely. The use of compact (mobile) shelving will increase the capacity of the archives per square foot of floor space considerably—but it requires an absolutely flat floor and a hefty front-end purchase and

installment investment.

Assuming standard baked-enamel, heavy gauge (18-gauge) metal shelving, each unit of which has six (6) load-bearing shelves[4] that are 16" x 36", and each shelf has a capacity of 3 cubic feet of records, then each unit holds 18 cubic feet of records. Each unit requires, in addition to its own depth, an additional aisle space for access and pulling records out. A minimum of an additional 18 inches is required between rows of shelving, but for human access, an additional 10-12 inches is required, so that aisles are 30 inches wide.

Assuming that shelves are facing each other, with an aisle between, then the "footprint" of space that each shelving unit requires is 36 inches by 31 inches (15+16). However, to err on the side of generosity, calculate the footprint of each shelving unit as a square that is 3 feet to a side, for a total of 9 square feet. Given these factors, the ratio of floor space to archives storing capacity is

9 square feet of floor space to 18 cubic feet of records, which, of course, equals

1 square foot of floor space is required for every 2 cubic feet of records[5]

That is, if you know you have 2,000 cubic feet of records, you also know that you need *at least* 1,000 square feet of floor space for shelving units. Remember to add at least 3 feet of floor space for end-aisles at each end of a row of several shelving units.

Common Box Containers

Container Type or Description	Linear Feet	Cubic Feet	Item Capacity
Document Cases[6]			
full-width, legal size 5.2” x 10.5” x 15.5”	0.50	0.50	800 pages
half-width, legal size 2.6” x 10.5” x 15.5”	0.25	0.25	400 pages
full-width, letter size 5.2” x 10.5” x 12.5”	0.50	0.40	800 pages
half-width, letter size 2.6” x 10.5” x 12.5”	0.25	0.20	400 pages
records center carton[7] 12.0” x 10.5” x 15.5”	1.00	1.15	2000 pages[8]
“Paige” or ”Banker’s”[9] 13.0” x 10.5” x 15.5”	1.10	1.25	2000 pages
“Xerox”[10] 12.0” x 10.5” x 18.0”	1.50	1.30	2775 pages
“Transfile”[11] 12.25” x 10.5” x 25.0”	2.10	1.90	3350 pages
flat cases[12]			
11.75” x 3.75” x 17.50”	1.50	0.45	600 pages
16.25” x 3.75” x 20.25”	1.70	0.75	600 pages
18.25” x 3.75” x 24.25”	2.05	1.00	600 pages
20.25” x 3.75” x 26.25”	2.20	1.20	600 pages
slip cases[13] 10.25” x 3.5” x 10.90”	0.30	0.25	560 pages

Card File Boxes	Linear Feet	Cubic Feet	Item Capacity
3” x 5” card file box 5.75” x 4.0” x 11.9”	0.50	0.15	1000 cards

Card File Boxes	Linear Feet	Cubic Feet	Item Capacity
5” x 8” card file box 9.0” x 6.0” x 11.9”	0.75	0.40	1000 cards

Note: If we assume a 36-inch-wide shelf with a vertical clearance of 11 inches, we can easily stack boxes one on top of the other and store 12 of the 3” x 5” boxes on a shelf, for a volume of 1.80 cubic feet; or we can easily store 4 of the 5” x 8” boxes on a shelf for a volume of 1.60 cubic feet. (but trying to store 6 of these larger boxes [2.40 cubic feet] on the shelf may be too tight a fit).

Microfilm Boxes	Linear Feet	Cubic Feet	Item Capacity[14]
35 mm box 1.75” x 4.1” x 4.1”	0.15	0.02	1000 frames
16 mm box 0.9” x 4.1” x 4.1”	0.08	0.01	2000 frames

Note: If we assume a 36-inch-wide shelf with a vertical clearance of 11 inches, we can stack boxes one on top of the other and store 120 of the 35 mm boxes on a shelf, for a volume of 2.40 cubic feet, or store 240 of the 16 mm boxes on a shelf for a volume of 2.40 cubic feet.

2. Common Cabinets

Drawers	Cubic Feet	Item Capacity
Map case drawer 52.5” x 2.5” x 40.0”	3.05	45 maps/drawings[15]
Standard Letter-size Upright File Cabinet Drawer 15” x 9.5” x 25”	2.05	4000 pages
Standard Legal-size Upright File Cabinet Drawer 17.5” x 9.5” x 25”	3.04	4000 pages
Lateral File Cabinet Drawer 25.0” x 10.0” x 16.0”	2.30	4000 pages
Standard 3” x 5” Card File Drawer 3.25” x 5.25” x 14.5”	0.15	1300 cards

Drawers	Cubic Feet	Item Capacity
Standard Microfilm Drawer 27.0” x 4.5” x 28”	2.00	
35mm		80 rolls
16mm		160 rolls
Standard Microfiche Drawer 12” x 5” x 28”	1.00	2800 fiche (sleeved), or 265 glass-plate photo negatives

Cabinets and Cases	Floor Area Occupied	Cubic Feet Capacity	Item Capacity
NOTE: Allow a minimum of four feet (48”) of aisle space in front of all cabinets to permit drawers to open fully without crowding people using the files.			
Map Case: Single, 5-drawer unit 54” x 16.25” x 46”	17.25	15.25	225 maps/drawings
3-unit map case stack (15 drawers) 54” x 47” x 46”	17.25	45.75	675 maps/drawings
4-drawer upright, legal-size filing cabinet 17.5” x 52” x 28”	3.40	8.20	16400 pages
5-drawer upright legal-size filing cabinet 17.5” x 56.5” x 28.0”	3.40	10.25	20500 pages
4-drawer lateral file cabinet 36.25” x 53.25” x 19.50”	4.91	9.20	18400 pages
10-drawer microfilm cabinet 29.25” x 52.5” x 23.5”	4.77	20.00	
35mm			800 rolls
16mm			1600 rolls
9-drawer microfiche cabinet 29.25” x 52.5” x 15.0”	3.05	9.00	25200 sleeved fiche or 4500 glass plate negatives

3. Common Shelving

Archives Shelving Capacity

NOTE: For archives shelving, assume that the standard vertical clearance between shelves is eleven inches (11”), and that the standard depth is sixteen inches (16”). Given that the only remaining variable dimension is shelf length (width from left to right as you face the shelf), we can calculate the following capacities.

Further assume that shelving construction is of 18-gauge heavy steel, and that shelves are not merely “cantilever” hung but are firmly secured to upright supports at least at two points on each end and at least one point along the back edge.

1. Single-shelf Capacities

Shelf Length	Cubic Feet	Paige Boxes	Center Cartons	Full-size Doc Cases	Half-size Doc Cases
36”	3.6	2	3	7	13
42”	4.3	3	3	8	16
*48”	4.9	3	4	9	18
*54”	5.5	4	4	10	20
*60”	6.1	4	5	12	22

2. “Bay” or “Unit” Capacities

A “bay” is a vertical “stack” of six shelves and a top, affording seven open spaces to put boxed records; multiplying the above figures by 6, we get the following capacities per bay.

Shelf Length	Cubic Feet	Paige Boxes	Center Cartons	Full-size Doc Cases	Half-size Doc Cases
36”	21.6	12	18	42	78
42”	25.8	18	18	48	96
*48”	29.4	18	24	54	108
*54”	33.0	24	24	60	120
*60”	36.6	24	30	72	132

* Longer shelf lengths require that you anchor shelves to at least three intermediate support points to metal along the back in addition to at least two points at each end.

4. Magnetic Audio Tape

Introduction

Item. The concept of "item" in audio recordings usually refers to the individual reel of tape, cassette-encased audio tape, analog disk, or compact (laser) disk.

Measure of Capacity. Audio recordings are also measured in terms of their capacity in hours and/or minutes of recording.

Sizes: widths, lengths and thicknesses. Audio tape comes in many sizes. Width of the tape varies from about one-eighth of an inch (1/8") to two inches (2"). It also comes in many lengths, up to about 300-400 feet. Thickness of the tape (in mils) also varies, usually from about 0.5 mil to 2.0 mil; and the thicker tape tends to be more durable and to produce better quality sound than the thinner tape.

Base Material: The base material of tape also varies. Early acetate tape becomes brittle and deteriorates rapidly. In more recent years, "mylar" tape has become the standard. Also important is the bonding layer that bonds the magnetizable material to the tape, and that (too) may vary.

Technological Variety. In addition to a great variety in capacity, size, and length, There is a great variety of recording technology, even for the general category of "recording tape" (or "audio tape"). Tapes may have from one to eight tracks, each capable of recording separate "sound events". Some are monaural and some stereophonic and some quadraphonic. Maintaining the variety of equipment necessary to playback the recordings may be difficult.[16]

We are concerned here with only the more common sorts of tape in the 1970s to 1990s, and we are concerned only with their bulk for storage. Dimensions are expressed as thickness, height, and width of the container in which the tape is commonly stored.

Type of Container/Material	Cubic Feet	Tapes Per Cubic Foot
Common Audio Cassette (3/8" wide tape; encased) 0.625" x 2.75" x 4.25"	0.005	200
Open-reel Audio Tape (5-inch diameter reel; boxed) 0.625" x 5.25" x 5.25"	0.011	90

Open-reel Audio Tape (7-inch diameter reel; boxed) 0.625” x 7.25” x 7.25”	0.020	50

5. Magnetic Video Tape

Introduction

Video tape, like audio tape, comes in many varieties and sizes. The bulk of some of the more common video cassettes (now being replaced by video discs) is shown below.

Cassette Type	Cubic Feet Capacity	Playing Time	Cassettes per “Paige” Box
1” wide SONY 2.0” x 10.5” x 10.5”	0.128	60 minutes	7
1” wide SONY 0.167” x 0.958” x 0.958”	0.153	96 minutes	7*
1” wide FUJI 2” x 12.5” x 12.5”	0.181	60 minutes	5*
¾” wide U-MATIC 1.5” x 10.0” x 7.0”	0.060	60 minutes	14
½” wide BETACAM 1.25” x 6.75” x 4.75”	0.023	20 minutes	27
½” wide VHS 1.25” x 8.0” x 4.75”	0.027	120 minutes	

6. Motion Picture Film

Introduction

The capacity of motion picture film is measured in

- running time (hours and minutes);
- number of individual frames (images);
- rate (frames per second past the lens in cinematography and projection; and
- length (feet and inches).

It comes in many sizes, but usually in widths of 8 mm, 16 mm, and 35 mm.

When put onto reels and in containers (circular “cans”), it is described by the diameter of the reel.

Container	Cubic Feet
8 mm film:	
3” diameter can	0.002
6” diameter can	0.006
9” diameter can	0.014
12” diameter can	0.025
16 mm film:	
3” diameter can	0.037
6” diameter can	0.147
9” diameter can	0.331
12” diameter can	0.589
15” diameter can	0.921
18” diameter can	1.326
35 mm film:	
12” diameter can	0.131
15” diameter can	0.818
18” diameter can	1.179

Calculating the Volume of Bound Records

Bound records in county archives come in many sizes, so there is no constant. Measuring and calculating the exact cubic foot volume of each item is tedious, troublesome, and unnecessary. The volume of holdings may be estimated in rougher terms than for paper records that are stored in folders and boxes that are more or less of uniform size.

You can make do with a rough estimate, but it can be a *reasonable and calculated* estimate. The following calculated sizes should be used as a rule of thumb, not as a hard and fast measuring standard. Exceptions should be taken into account when they differ significantly from these calculated sizes; otherwise when estimating the volume of holdings of bound records, use these standards. Review your holdings. Count or estimate that you have

so many large, thick volumes, [c. 21.5” x 15.0” x 3.50”] = **0.55 cu. ft. each**
so many large, thin volumes, [c. 21.5” x 15.0” x 0.75”] = **0.14 cu. ft. each**

so many medium thick volumes, [c. 16.0” x 11.0” x 1.50”] = **0.15 cu. ft. each**
so many medium thin volumes, [c. 16.0” x 11.0” x 0.75”] = **0.08 cu. ft. each**

so many small thick volumes, and [c. 12.5” x 8.50” x 1.50”] = **0.09 cu. ft. each**
so many small thin volumes. [c. 11.5” x 8.50” x 0.75”] = **0.05 cu. ft. each**

[The cubic footage figures are not exact and have been rounded off.]

Calculate the total volume for each size classification, and then add the results for the total volume of holdings of bound records (estimated).

Note that the best storage medium for most large bound volumes is the standard metal roller shelves that may be found in many county courthouse offices holding the older large bound ledgers. Such storage places the least strain on the ledger volumes and on the staff who have to handle them.

It is also advisable to make or acquire book “cradles” (v-shaped “wings” of metal or board) onto which large books can be laid for reference, to ease the strain on bindings.

Calculating Shelving Needed

Whenever buying shelving, calculate the total cubic footage of holdings to be stored on the shelves. Then multiply that by 1.3 because for all storage on shelving there is likely to be at least some wastage of empty space because not all boxes and bound volumes fit exactly on all shelves.

Note that shelving should be at least 16” deep to accommodate deeper boxes and bound volumes without overlap and so that all materials are recessed at least a little bit on the shelves. The best shelving for paper archives is heavy (18-gauge) steel with baked enamel surfaces, well-braced at the backs and ends of shelving units so as to prevent shelves from twisting under full loads.

[1] A separate handbook with metric measures will be prepared as needed. Meanwhile, users must convert by standard formulae (e.g., one inch equals two and fifty-four hundredths centimeters: 1 in. = 2.54 cm.).
[2] All dimensions in these tables are given in that order.
[3] Fixed records center shelving, for example is typically 14 feet high and each shelf level is about 3-foot square; common county archives shelving, however, is seldom taller than 7 feet high and shelves are 16 inches deep and 3 feet wide, or thereabouts.
[4] Records should not be placed on the top (cover) shelf because of potential water damage and because that usually puts them too close to lighting fixtures.
[5] Remember that this ratio is suitable only for the conditions stated. Shelving of other sizes with produce different ratios.
[6] Often referred to as standard archives box or "Hollinger box" after one of the more popular vendors of the product, even though other suppliers offer a similar product.
[7] A box with folded-in top and bottom.
[8] Records centers often reckon this as 3,000 pages because in common office files there are fewer folders and the records are more tightly packed than in archives.
[9] A patent-design box roughly the size of a records center carton, but sturdier and with a separate stiff lid.
[10] The sort of box that standard size copier paper comes in; often used by private individuals and commercial firms for boxing their records for retirement to records centers and archives..
[11] A long "banker's box , often with collapsible plastic handles at either end for carrying.
[12] Also referred to as "suit cases" or "pizza boxes" from their familiar shape.
[13] A sort of half-box, open on two of its six faces, for inserting pamphlets, etc., stored on bookshelves.
[14] Microfilm is one roll per box, and a full roll is 1,000 frames for 35mm and 2,000 frames for 16mm.
[15] For maps and drawings, it is assumed that no more than five (5) items will be stored touching each other and that between at least every five items there is a sheet of acid-neutral interleaving.
[16] There are, of course, many other forms of sound recording, including wire recording, disk recording, *dictabelt* recording, and motion picture sound tracks. [The latter was used as a recording device by Franklin D. Roosevelt's staff, long before Richard Nixon's famous White House recording system.]