

4 RECORDS STORAGE OPTIONS

4.1 General Requirements

The majority of space in an archival facility is dedicated to the safe storage of the records. The challenge is to store and protect the collections while still making the records accessible to researchers. A key component in this strategy is careful planning of the shelving and accompanying storage equipment, including cases, cabinets, racks, and other furniture that supports the collections.

The general requirements also apply to records center shelving. However, records centers traditionally aim for increased density of storage and are often more likely to go with higher shelving heights and denser storage within the shelving system.

Shelving is a long-term investment for an archives building and must be planned to meet the specific needs of the archival facility and reflect the size and quantity of its collections. The choice of a shelving system or combination of systems depends on a number of factors, including the buildings' size and structure, budget, operations, and technical considerations.

Shelving Types

Archival shelving can be either fixed or mobile shelving of various densities, with mobile systems being either manual or electrically operated. Static or fixed shelving is less expensive to purchase and install but requires a larger floor area than mobile shelving. Compact mobile shelving can store more records in a smaller space resulting in savings on land costs, building size, construction costs, building operations costs, and the long-term costs for conditioning the storage spaces. An advantage of electrically operated mobile shelving is the ability to connect it to the fire protection system and its potential to enhance security by locking mobile units. Mobile shelving requires a heavier floor load than static shelving and may not be feasible in existing buildings.

Shelving Heights

The height of the shelving can vary depending on desired retrieval of the records along with the building's structure, footprint and ceiling height. Traditionally the standard shelving height has been 84 to 90 inches providing 7 shelves that are 12 inches apart. This allows access to all the shelves with a ladder. However higher shelving systems and increased density heights are increasingly more common to offset the increased costs for archival storage. Current fire protection standards allow mobile electric high bay shelving to go as high as 30 feet without in-rack sprinkler installations, as long as the materials are stored in boxes. Shelving taller than 8 feet requires the use of rolling ladders, lifts, or a mechanical retrieval system.

Shelving Aisles

The maximum length of the storage room aisles are dictated by the footprint of the room, the location of doors, the type of shelving system, preferred retrieval and access time, and life safety codes.

The width of the aisles between ranges of shelving is different depending on the footprint of the room, the shelving system, and if ladders or lifts is needed. In general, aisles between rows of shelving should be minimum of 36 inches, although 42 inches is preferable; that distance will increase with lifts. Often a main aisle is provided for each room that can range in size from 4 feet to 8 feet wide depending on cart, ladder and lift use.

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Shelf Size

Archives should maximize their storage capacity with a standard sized shelf that accommodates the use of archive boxes, records center type boxes, and some special media records. Specialized shelving sizes are required for oversized and special sized records.

Storage can be designed using single or double-sided deep shelving units. Generally, archives shelve boxes using single sided shelving units. Records centers often increase the density and shelve using double-sided, double deep shelving units.

Standard archival shelves measure 16 inches x 40 inches. However, there are other effective shelf size options.

The bottom shelf should be at least 4 inches off the floor; 6 inches is preferred.

Materials

All shelving should be all steel and finished with an electrostatically applied powder coated finish. Each shelving unit must have solid steel shelves.

Aluminum shelving is acceptable for artifacts.

Open style chrome-plated stainless steel wire racks are recommended for cold storage rooms.

Since a site has not been selected for this project, this programming report considered several shelving options, including both fixed and mobile shelving.

4.2 Shelving Density Analysis

Chapter 3, Evaluation of Current Holdings (pg 27) established the City's storage need as 506,733 cubic feet of materials, 185,309 cubic feet of Archives storage and 321,424 cubic feet of Records Center storage. These materials are to be stored in controlled conditions on a shelving system that best suits the needs of each material type. The primary concerns for selecting a storage option are:

1. Storage Efficiency
2. Records Access
3. Shelving and Building Construction Costs
4. Operating Costs

Storage efficiency is determined by the type of shelving and the number of shelves per unit. Compact mobile shelving units house records more efficiently than fixed shelving types.

This analysis considers fixed and compact mobile shelving types at three storage densities: low (7 shelves), medium (15 shelves), and high (25 shelves). To account for building structure, aisle widths, and separation distances of closed compact mobile stacks, typical storage configurations have been created for each storage option in Appendix F - Naylor Court Documentation (pg 309). The total cubic feet of storage has been divided by the shelving type density factor to determine the room square footage required. Considering the 507,000 cubic feet of materials calculated previously, the square footage required for records storage has been determined and presented in Table 4.1.

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Table 4.1 Comparison Between Shelving Types

CF to SF Ratios for Shelving Types	CF:SF*	CF of Storage	SF Footprint Needed for Storage
Ratio for 7 High Fixed Shelving	2:1	507,000	253,500
Ratio for 7 High Compact Mobile Shelving	3.8:1	507,000	133,421
Ratio for 15 High Fixed Shelving	4.4:1	507,000	115,227
Ratio for 15 High Compact Mobile Shelving	8:1	507,000	63,375
Ratio for 25 High Fixed Shelving	11:1	507,000	46,091
Ratio for 25 High Compact Mobile Shelving	17:1	507,000	29,824

*Uses 80% efficiency allowing for shelving superstructure and voids

4.3 Building Size Implications

Utilizing these density factors, building area requirements were calculated for the various shelving types; a denser high bay compact mobile shelving requires the least area (29,824 SF), while a fixed shelving of low density requires the most area (253,500 SF) to house the same quantity of Archives and Records Center records. It is important to note that the Archives storage and Records Center storage, including the associated building systems, account for sixty-three percent of the new DC Archives building program.

Utilizing the various shelving densities and the balance of the proposed building program for the new DC Archives facility, building size options were generated for a new or renovated stand-alone Office of Public Records (OPR) facility. These options consider the impact of building type (new versus retrofit) and storage type (low, medium, or high density shelving).

Options considered (refer also to Appendix J - Expanded Option Descriptions & Cost Estimates, pg 343):

- 1: New stand-alone OPR facility with 15 shelves high compact shelving.**
This option describes a stand-alone and purpose-built Archives building as outlined in the city's original RFP. The area of the DCPL Operations Center is addressed, but is shown to be accommodated as part of a separate DCPL project. (Refer to Chapter 8, Co-Location Opportunities, pg 205 for further information on the opportunity to include the DCPL Operations Center with the new Archives and Records Center facility.)
- 2: Retrofit OPR into an existing building with 7 shelves high fixed shelving.**
This option describes a stand-alone OPR facility that is retrofit into a renovated existing typical DC office building. Storage areas expand dramatically as a result of the assumption that only 7-high fixed shelving can be used due to limited structural load capacities and floor-to-floor heights. The DCPL Operations Center is addressed as a separate DCPL project.
- 3: New stand-alone OPR facility with 25 shelves high fixed shelving.**
This option shows the space-saving benefits of utilizing a fixed high bay shelving system. The DCPL Operations Center is assumed to be co-located with the OPR facility.

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- **4: New stand-alone OPR facility with 25 shelves high compact shelving.**

Option 4 shows the further space-saving benefits of utilizing a compact mobile high bay shelving system. The DCPL Operations Center is assumed to be co-located with the OPR facility.

The resulting program sizes of each storage option is presented in Table 4.2. In comparing these options, Option 2 requires the largest building footprint. If OPR is to retrofit an existing facility, then it is likely that this building was not originally designed for archives storage. The archival material and shelving together form a substantial live load that most existing buildings could not withstand unless low density (7 shelves high) units are used. Additionally, most existing buildings in DC lack the ceiling height required for 15 high or 25 high units. As a result, it is anticipated that only the least efficient storage systems can be used in a retrofit, resulting in a larger building.

Comparing options 1, 3, and 4, the benefits of higher density storage can be seen not only in the usable square feet, whose footprint was calculated in the previous section, but also in the gross square feet. Since this building size is scaled proportionally to incorporate circulation and building system space, there is an even greater benefit to minimizing the overall scope of the storage.

It is important to note that an efficient building like Option 4 could have higher operational costs due to the staffing and equipment required to pull records from high-density storage solutions. Consideration of likely operating procedures for the facility would be necessary to determine if staffing or software solutions could be used to offset these challenges.

Additional options for synergies with the DC Public Library Operations Center are presented in Chapter 8, Co-Location Opportunities (pg 205). Recent archival facilities, including the City of Ottawa Archives, have taken advantage of the benefits of co-location of Archives with library operations, such as a distribution center, and both benefit from shared spaces and costs.

Table 4.2 Stand-Alone Building Options (New & Renovation)

Stand-Alone OPR Facility				
	Purpose-Built New Building Compact Mobile Shelving / Medium Density 15 Shelves High DCPL Operations Center Not in OPR	Retrofit into Converted Existing Building Fixed Shelving / Low Density 7 Shelves High DCPL Operations Center Not in OPR	Purpose-Built New Building Fixed Shelving / High Density 25 Shelves High DCPL Operations Center Co-Located at New OPR Facility	Purpose-Built New Building Compact Mobile Shelving / High Density 25 Shelves High DCPL Operations Center Co-Located at New OPR Facility
	Option 1	Option 2	Option 3	Option 4
Reception Area	4,450	4,450	4,450	4,450
Research Area	4,740	4,740	4,740	4,740
Staff Work Areas	9,590	9,590	9,590	9,590
Records Receiving	3,410	3,410	3,410	3,410
Archival Storage	23,200	92,700	16,900	10,800
Records Center Storage	40,200	160,700	29,200	18,900
DCPL Operations Center	15,000*	15,000*	15,000	15,000
	100,590	290,590	83,290	66,890
	<i>Total</i>	<i>Total</i>	<i>Total</i>	<i>Total</i>
Total Net Square Feet (NSF)	100,590	290,590	83,290	66,890
Total Gross Square Feet (GSF)	135,665	391,916	112,332	90,214

*In this option, the DCPL Operations Center would be located in a separate DCPL facility, but the area is included here to equalize the comparisons.

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4.4 Cost Implications

After the building area numbers (square feet) were tabulated, cost data was calculated. The cost data for the shelving types, new construction, and renovation was calculated using shelving vendor pricing and benchmark cost data for similar archival buildings. A summary compares the various options for both gross square footage requirements and estimated construction costs (including shelving costs). Each of the options, 1 through 4, can be found in Table 4.3 with its corresponding construction cost.

Option 4 has the lowest overall construction cost but the highest cost per square foot. Efficient shelving systems are costly and result in higher costs per square feet, but the reduction in building footprint more than offsets this expense. Option 2, even using an existing building, is the most expensive due to the required large footprint. Options 1 and 3 are the moderate cost options with similar costs per square foot.

Table 4.3 Construction Cost, Options 1 through 4

Stand-Alone OPR Facility				
	Option 1	Option 2	Option 3	Option 4
	Compact 15	Fixed 7	Fixed 25	Compact 25
	New Building	Retrofit Building	New Building	New Building
Building Footprint	135,665	391,916	112,332	90,214
Total Cost	\$62,328,526	\$123,935,179	\$51,599,190	\$47,373,763
Overall Cost / SF	\$459.43	\$316.23	\$459.34	\$525.13

4.5 Assessment & Comparison

We assessed the options based on the following criteria:

Evaluation Criteria

- Building Footprint
This objective minimizes the building square footage required to house known Archives and records storage needs. More compact shelving reduces the building area required.
- Building Cost
This criterion seeks to minimize total building construction costs.
- Ease of Retrieval
The goal is to optimize the time of records retrieval.
- Retrieval Safety
Safety is paramount when accessing records stored in shelving systems. This criterion assesses retrieval safety based on ready access, ladder access, or lift access.
- Operational Flexibility
Some shelving systems require ladder or lift access. OSHA requirements limit the types of employees that can operate retrieval equipment, which normally prohibits an archives facility from utilizing interns or volunteers to pull records above a certain height. The goal of this criterion is to maximize OPR's staffing options.

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- Maximize Records Access
This objective measures the quantity of records that are readily accessible within the first seven feet of shelving.
- Shelving Cost
This criterion seeks to minimize the total shelving costs. Shelving cost is impacted by the cost of the system itself and the footprint of shelving required based on the storage density.
- User Preference
This criterion records the user preference for the shelving system that best meets OPR's needs.

	Option 1 <i>Purpose-Built New Building Compact Mobile Shelving/ Medium Density 15 Shelves High</i>	Option 2 <i>Retrofit into Converted Existing Building Fixed Shelving/Low Density 7 Shelves High</i>	Option 3 <i>Purpose-Built New Building Fixed Shelving/ High Density 25 Shelves High</i>	Option 4 <i>Purpose-Built New Building Compact Mobile Shelving/ High Density 25 Shelves High</i>
Building Footprint	—	✗	✓	✓
Building Cost	✓	✗	✓	✓
Ease of Retrieval	—	✓	✗	✗
Employee Safety	✓	—	✓	✓
Operational Flexibility	✓	✓	✗	✗
Maximize Record Access	—	✓	✗	✗
Shelving Cost	✗	✓	✓	—
User Preference	✓	✗	✗	✗

Figure 4.1 Evaluation of Stand-Alone OPR Facility Options

The resulting chart shows that Option 1, which provides a new purpose-built facility with medium density (15-high) compact mobile shelving, qualitatively has the highest scores. This is followed by Options 3 & 4, which provide a new purpose-built facility with high bay fixed or compact mobile shelving. Due to the limitations to be found in retrofitting an existing building, Option 2 is limited to low density (7-high) shelving which is inefficient and takes a large footprint.

Whereas the high bay options are valid for a new clean site, additional considerations arise which point to Option 1 as most likely being the optimal candidate for the DC Archives:

- It offers a good balance between the cost and space benefits of higher density while not pushing the operational impact to the full maximum.
- It is consistent (albeit coincidentally) with the density assumption of the RFP.
- High bay shelving requires very specialized shelving access equipment, whereas the 15 shelf system provides easier access.
- If DC budgets for this option which has a slightly higher cost than Option 3, there could be some contingency for having some of the record storage portion of the facility be high bay fixed shelving.

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- Within this option, we also offer the following operational recommendations:
 - Organize the shelving locations for the most frequently retrieved records on the lower 7 shelves that are reachable without using a ladder or lift.
 - Organize the shelving locations for less frequently retrieved records on the middle tiers of shelves (say 8 thru 11) for retrieval using a rolling ladder.
 - Organize the shelving locations for the least frequently retrieved records on the upper tiers of shelves (12 thru 15) for retrieval using a lift.

In discussing these options with the DC OPR, they place a higher value on using a 15-high shelving system as compared to a specialized high bay system and believe that the operational and program efficiencies achieved with Option 1 are most desirable. In other words, though the building footprint is shown as fair and the shelving cost is shown as poor in Option 1, these ratings are within the bounds of acceptability for DC. Furthermore, Option 1 rates higher than Options 3 & 4 in ease of retrieval and maximize record access and would thus be preferred to a facility using a high bay system. However, if the appropriate site is found — such as a new clean site — Option 3 could be considered for all or a portion of the facility.

For planning purposes, DC OPR has elected to move forward with a program that is based on medium density compact mobile density shelving (refer to Table 4.1 Comparison Between Shelving Types, pg 37, Option 1) and includes the co-location of the DCPL Operations Center (refer to Chapter 8, Co-Location Opportunities, pg 205, Option C).

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