# Audio, Video, and Image Digitization: Technical Specifications and Best Practices

## Introduction

This document provides basic specifications for audio, video, and image digitization. While exact specifications should be decided on a project-by-project basis, the following recommendations should be sufficient for most audio, standard definition video tape, and photographic and textual documents. As a general rule of thumb, preservation masters should be saved in an uncompressed or, in the case of video, losslessly compressed format.

## Audio Digitization

### Preservation Masters:

The proper specifications for preservation masters depend upon the source materials being digitized and, in some cases, the amount of storage one can dedicate to saving digitized audio. The recommendations below will suffice for any digitization project in terms of the amount of audio information captured. When digitizing music and language recordings, it is more important to digitize according to current best practices, like the ones below. For relatively low-quality recordings of spoken English, it may be possible to record at lower specifications (e.g., 16-bit / 44.1 KHz) without losing meaningful content. However one decides to capture audio, one should save preservation masters as a wav file or another uncompressed audio format.

- File Format: wav
- Bit Depth: 24-bit
- Sample Rate: 96 KHz

**Access Copies:**
One of the most widely used audio formats that employs lossy compression is mp3. This format can be ready by most media players and, for this reason, is recommended by most reputable sources for access copies. The recommended bit rate varies, with 192 kbps landing within the rates recommended. Keep in mind that a higher bit rate means less detail from the original wave is lost. 44.1 KHz is also a common recommendation as some formats, such as cassette tapes, cannot record at a higher rate. While information will be lost by down sampling from a higher rate, chances are, the difference won't be registered by the casual listener.

- File Format: mp3
- Bit Rate: 192 kbps
- Sample Rate: 44.1 kHz

## Video Digitization

When considering technical specifications for digitized video, it is important to remember that we often associate the wrapper with the file format. In many cases, a wrapper can contain both compressed and uncompressed video, depending upon how the video file is exported. When considering file format, the encoding method, or codec, is the key factor in determining whether a video is compressed or uncompressed, while the combination of wrapper and codec will determine which media players can read the file. For example, mov is a wrapper that can be read by Quicktime Media Player. This wrapper can hold uncompressed video, as well as several other video formats. On the other hand, H.264 is a widely used compressed video codec that can be contained in an mov file, as well as an mp4.

**Preservation Masters:**
Currently, there is no consensus on the best file type for preserving digitized video. The suggestions below are either uncompressed formats or formats that use loseless compression. While these formats best serve the long terms needs of archival institutions, each requires an immense amount of digital storage. For institutions that are unable to preserve uncompressed video, exporting video using the H.264 codec in a commonly used wrapper such as mov or mp4 is a potential alternative. Regardless of the file type one uses, one should match the resolution of the original. In some video editing software there is an option to "Match Source." The recommendations provided below provide standards for standard definition video tape created according to the National Television System Committee (NTSC) standards, which was commonly used in North America.

- Wrapper/Codec: MOV / uncompressed (8- or 10-bit), MOV / JPEG2000, AVI / uncompressed, MKV / FFV1
- Sample rate: 4:2:2
- Resolution: 480x720
- Frames per second (fps): 60 for interlaced (e.g., 480x720i)
- Field order (only applicable for interlaced video): lower-field first

**Access Copies:**
While it is difficult to decide what the best archival format, there are a couple of formats that make sense for access copies. Most media players can read mp4 making it a good choice for access. In some cases, moving images may have already been digitized as mpeg2s or transferred directly to DVDs by a consumer grade VHS to DVD deck. In these cases, it makes little sense to convert the mpeg files to mp4s, as the mpegs make perfectly good access copies.

- Wrapper/Codec: mp4 / h.264
- Resolution: 480x720 for SD, 720x1280p for film or HD
- Frame rate: 60 fps for interlaced video, 30 fps for progressive HD video, 24 fps for film

## Image Digitization

**Preservation Masters:**
The specifications below are minimal specifications for most all photographic and textual documents. Current best practices developed by the Federal Agencies Digitization Guidelines Initiative (FADGI) call for higher resolutions for larger photographic or cartographic formats. See the resources at the end of this document for current guidelines.

- File format: TIFF
- Color bit-depth: 16-bits / channel (16-bit grayscale or 48-bit color)
- Resolution: 4000+ pixels along the long edge

**Access Copies:**
These specifications provide reasonable access to most documents and photographs. For larger documents containing more minute details, 150 dpi is a more useful guideline. For negatives or very small documents, 600 pixels is preferable.

- File format: JPEG
- Color bit depth: 8 bits / channel (8-bit grayscale or 24-bit color)
- Resolution: 150 dpi or 600 pixels along the long edge

## Further Resources

### Audiovisual Digitization

- Duke University Libraries DPC Audio/Video Digitization Standards and Equipment
- Indigitization Toolkit for the Digitization of First Nations Knowledge, Section C 2: Standards
- JISC Digital Audio Formats and Compression
- UCLA Library AV Preservation: Digitization Specifications
- Yale University Libraries Digital Retention and Capture Guidelines

### Still Image Digitization

- FADGI Technical Guidelines for Digitizing Cultural Heritage Materials, 2010
- FADGI Still Image Technical Guidelines, 2015 (DRAFT VERSION)