# Guide to Ceramic MNV Calculation Qualitative and Quantitative Analysis

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### ABSTRACT

Although calculating the minimum number of vessels (MNV) is common in many historical archaeological studies, the method is not consistently applied. Reasons for using MNV methodologies to describe a ceramic assemblage are deceptively simple. As others have pointed out, overall counts and ceramic weight can provide relative information on the distribution of ceramics across a particular site and the formation of the archaeological record. Most practically, MNV ceramic counts (rather than individual sherd counts) best illustrate how items were used before they entered the archaeological record.


### Introduction

> "People don't use sherds, they use vessels."
> Barbara Voss,
> *The Archaeology of El Presidio de San Francisco*

Historical archaeologists commonly record ceramics in the field and in the laboratory. Minimum Number of Vessel (MNV) counting is by no means a new idea, but one that bears highlighting for future studies. In brief, MNV counts describe the minimum number of original items that can account for the fragmentary specimens present in the archaeological assemblage. MNV counts are not a substitute for specimen counts or specimen weight. Instead, MNV counts provide substantially different information that can contribute to interpretation of depositional and post-depositional processes, site chronology, and social behaviors such as purchasing patterns and the historical use of ceramic vessels.

Methods for determining MNV counts are varied, although there are essentially two methods of calculating MNV counts (Rice 1987:292–293): the quantitative and the qualitative. Quantitative MNV assessments are based on counts and measurements of rim sherds, bases, or handles. The advantage of quantitative techniques is that they are replicable and relatively expeditious. They are particularly useful for quantification of mass-produced ceramics for which vessel attributes (form, size, glaze, and decoration) are highly standardized. Quantitative MNV assessments may result in a disproportionately low vessel count for handcrafted and undecorated vessels. This is because quantitative MNV methods usually disregard body sherds and do not take paste composition, temper/inclusions, glaze, and manufacture technique into account.

Qualitative MNV counts subjectively assess and group together sherds that likely represent a single vessel. This method is not as replicable (i.e., MNV groupings vary from analyst to analyst). Its strength is that it allows the analyst to take multiple attributes into account and is less likely to undercount undecorated and handcrafted vessels disproportionately. To compensate for the subjective nature of this process, defining attributes for each MNV grouping should be clearly recorded. This permits other analysts to reevaluate the MNV groupings for future studies.

In defining MNVs, the analyst should consider all ceramic sherds within a given ware type category (e.g., majolica, blue transfer print, stoneware, etc.). For each sherd there are three possibilities: (1) a sherd could be assigned to a group of specimens representing a MNV with shared attributes; (2) a sherd may have unique attributes, not shared with other specimens, that indicate that it represents a MNV; or (3) a sherd could have attributes that would allow it to be assigned to more than one MNV grouping. Sherds falling into the third category should be set aside and excluded from MNV calculations.

As a result, only a fraction of the ceramic sherds within a given ware category can generally be assigned to an MNV grouping. Typically, the more abundant the sherds in a ware category, the lower the frequency of sherds assigned to MNV groupings. This is because the more MNV groupings are defined for a particular ware type, the more likely it is that a given sherd will share characteristics with more than one MNV. For example, a body sherd could have the same paste, glaze, and decorative attributes as an 8 cm diameter rim sherd and a 12 cm diameter rim sherd. The resulting minimum-vessel groupings consist of a sherd or group of sherds that uniquely share a constellation of specific attributes, including vessel form, rim form, vessel diameter (at rim and/or base), manufacture method, decoration, paste characteristics (including paste color and inclusions/temper), and surface treatments.

In grouping sherds into MNVs, it is best to be rigorously conservative. If there is any possibility that two sherds *could* be from the same vessel, they should be grouped together even if their attributes are somewhat different. For example, two rim sherds with slightly different rim profiles can be grouped together if intravessel variation can account for variation in rim profiles. Likewise, two sherds with different paste colors but similar inclusions/temper can be grouped if it is possible that color differences could be attributed to differential firing of the vessel. These considerations reduce the possibility that spurious or fictitious minimum vessels are created during the subjective minimum-vessel grouping process.

Regardless of the admitted imperfections embodied within both quantitative and qualitative analysis, the importance of defining minimum-vessel groupings cannot be overstated. To put it simply, people don't use sherds; they use vessels (Voss 2002:661). Identifying minimum numbers of vessels brings the archaeologist one step closer to reconstructing the functional and symbolic role of ceramic artifacts in the past.

## MNV Estimation in the Field

When recording historic ceramics on a site, think in terms of MNV (Figure 1). How many plates? cups? bowls? Stating the number of sherds can be deceptive in terms of site characterization: 1 sherd can equal 1 pot, 8 sherds can represent 1 bowl, or 80 sherds can represent 1 large platter. Breakage can occur both during original use of the vessel and also long after the sherds are discarded. For example, a single ceramic sherd can be easily broken into multiple fragments by vehicles driving through a site, or by human or animal trampling. Conversely, buried sherds or surface sherds in less-accessible areas of a site are less likely to be affected by postdepositional breakage. These examples illustrate why sherd count alone can be an unreliable measure of how the site was used, and the count cannot be used to characterize the overall artifact assemblage.

Instead of counting sherds, learn to look instead at the numbers of rim sherds, bases, or other attributes to help determine how many whole artifacts were once on the site, not the number of broken pieces. Learn how to make MNV estimates. Site records are usually not intended to be the end-all of information about an archaeological site, but are meant to characterize both

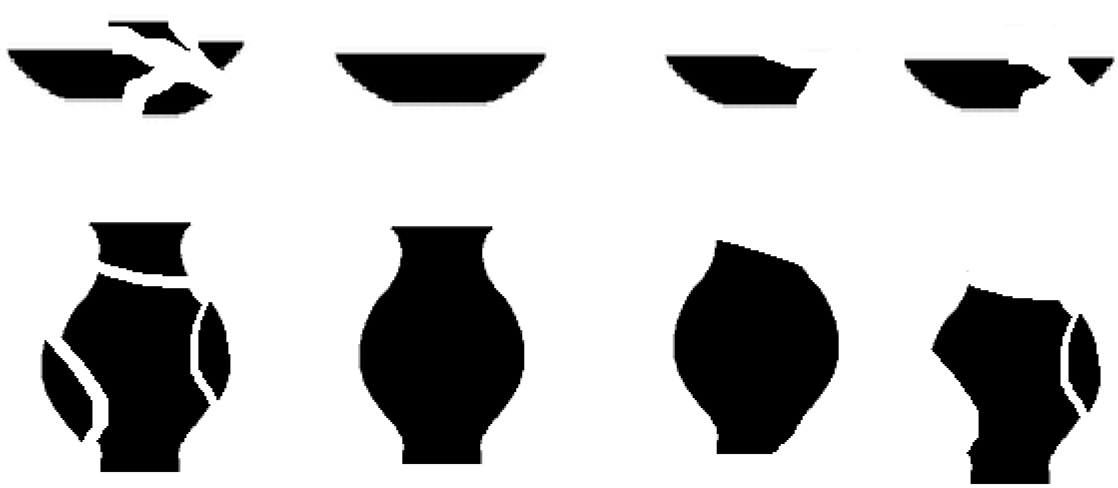

**Figure 1.** Each row shows the equivalent of one MNV. A single vessel can be represented by several sherds that can reconstruct the vessel in its entirety with several fragments missing, but with characteristic form such as a base or rim. (Illustration by R. Allen, 2009.)

the kind and general function of occupation or use. Knowing the ceramic MNV can help to clarify site use and characterize the overall artifact assemblage and/or its relationship to features. Is the site a trash dump? domestic assemblage? industrial waste site with byproducts? temporary camp site?

Given the limited time that is normally available for site recordation, most archaeologists use qualitative MNV calculation methods in the field. The majority of historic ceramics can be divided into three general categories that can provide a starting place for estimating MNV: (1) earthenware, (2) porcelain, and (3) stoneware.

The following categories (revisited in the laboratory discussion later in this article) can further help to estimate MNV in the field: vessel form (bowl, cup, plate, jar, etc.); manufacture style (molding, casting, pinching, etc.); surface treatment and decoration (transfer print, painting, base marks, etc.); body characteristics (color, temper); and external modifications (burning, drilling, etc.).

For example, a concentration of ceramics from a trash-dumping area could be described as 14 sherds of white improved earthenware (Figure 2). This says little about the site function or the site association. Using MNV methodologies, the assemblage could be estimated as: ≅4+ white earthenware plates, ≅2 white earthenware cups, ≅2 white earthenware saucers, and ≅6+ white earthenware flatware vessels; the MNV estimation determined by makers' marks and body shape.

The advantage to this characterization is that it suggests a domestic assemblage, and perhaps even represents one household dumping event within the larger city trash dump. Noting the presence and kinds of makers' marks is also important to dating the assemblage. Interpretations gathered from field assessments of ceramic MNV can then be evaluated in conjunction with any available documentary evidence.

Figure 3 shows a similar probable domestic assemblage, where body decoration as well as makers' marks and body

**Figure 2.** White improved earthenware from a trash-dump area. (Photo by R. Allen, 2002.)

**Figure 3.** White improved earthenware with additional body decoration from a trash-dump area. (Photo by R. Allen, 2002.)

shape can be used to determine MNV. Remember, the point of estimation in the field is not to be exact—given two minutes, five archaeologists may come up with five different estimations. The purpose is to assist in better characterizing the site's use and content rather than simply counting (or estimating) the number of sherds. If exact vessel shapes cannot be determined, the more generic terms of *flatware* (plates, saucers, etc.) or *hollowware* (cups, bowls, etc.) can also be used.

Figure 4 shows a possible domestic assemblage that is more industrial (oil cans, etc.), where it is not practical to estimate ceramic MNV. In this instance, metal cans are the more prominent artifacts, and description of these materials can better help to characterize the site and its assemblage. The presence of white improved earthenware can be noted but not necessarily counted, especially if time is limited.

## MNV Recordation in the Laboratory

In the laboratory, MNV recordation becomes more sophisticated, and both quantitative and qualitative methods can be used. Figure 5 is adapted from sample minimum-vessel recordation sheet intended for one form per vessel that was developed for a ceramic-analysis project that included both hand-formed and mass-produced ware types, and used quantitative as well as qualitative methods to determine MNV groups. A recordation sheet such as this can be adapted to fit the particular attributes of a given ceramic assemblage as well as the research goals of the project.

Vessel attributes recorded for each MNV can be roughly divided into eight major categories. Seven of these are categories of primary attributes that can be interpreted directly from the specimens themselves. These are: ware type, form, method of manufacture, surface treatment

**Figure 4.** An assemblage from a trash area for which it is not practical to estimate ceramic MNV. (Photo by R. Allen, 2002.)

and decoration, body characteristics, burning, and completeness. Many other scholars have made suggestions for standardized procedures for recording these attributes: Colton (1953), Shepard (1956), Rye (1981), Chase (1985), Miller (1986), Rice (1987), Sinopoli (1991), and Orton et al. (2003). The sample MNV recordation sheet considers these previous examples. The eighth major category includes those attributes which provide additional information when interpreted with documentary sources, such as makers' marks or the trade names of decorative patterns.

In the laboratory, analysis generally proceeds in five steps: (1) Subdivide the ceramic specimens into ware types; (2) For each ware type, determine whether quantitative or qualitative MNV assessment is most appropriate. All other things being equal, quantitative methods are more reliable for mass-manufactured ceramics, while qualitative methods are more appropriate for hand-formed and workshop-produced ceramics; (3) Whether using qualitative or quantitative MNV methods, identify which attributes will be most meaningful in determining MNV groupings for that ware type. For example, analysis of vessel form and decoration will likely generate the strongest MNV groupings for mass-produced tableware ceramics with standardized pastes and glazes. Hand-formed vessels will require careful analysis of surface treatment and body characteristics to avoid undercounting MNVs. Highly fragmented ceramic specimens of any origin may also require greater attention to paste and glaze characteristics; (4) Once the method and attributes have been determined for a given ware type, sort the ceramic sherds into MNV groupings using the selected attributes, setting aside any sherds with attributes of more than one MNV group. Cross-mending analysis, discussed later in this article, may also be conducted during this step; and (5) Record the selected attributes for each MNV

| | | | | | |
|---|---|---|---|---|---|
| | | **Vessel #** *15* | | | |
| | | **Waretype:** *unglazed earthenware* | | | |
| 1. Vessel Form: | 10. Decoration | | | | |
| *hollowware* | Interior: *undecorated* | | | | |
| 2. Rim Form: | Exterior: *undecorated* | | | | |
| *unknown* | | | | | |
| 3. Rim Diameter: | 11. Colors | 13. Burning | | | |
| *unknown* | Interior: *7.5YR 5/2* | Interior: *No* | | | |
| 4. Base Diameter: | Int. mar.: *N2.75 to N2.0* | Int. mar. *Yes* | | | |
| *unknown* | Core: *N2.75 to N2.0* | Core: *Yes* | | | |
| 5. Vessel Height: | | | | | |
| *unknown* | Ext. mar.: *N2.75 to N2.0* | Ext. mar. *Yes* | | | |
| 6. Thickness | Exterior: *5YR 6/8* | Exterior: *No* | | | |
| Minimum: *11 mm*<br>Maximum: *8.2 mm* | | | | | |
| 7. % of Vessel: | 12. Inclusions/Temper | 14. Cross Mended Sherds | | | |
| | Material: *sand, plant, white rock (not shell)* | Catalog # | # of sherds | Unit | Stratum |
| *0-5 %* | | *122* | *1* | *HF* | *9* |
| 8. Manufacture: | Volume (%): *30%* | *668* | *1* | *YH* | *13* |
| | | | | | |
| *handbuilt* | Particle size: *common nonplastic particles up to 3 mm or less* | | | | |
| | | | | | |
| 9. Surface Treatment: | Regularity: *good-fair* | | | | |
| Interior: *brushed* | | | | | |
| | | | | | |
| | | 15. Other affiliated sherds | | | |
| | | Catalog # | # of sherds | Unit | Stratum |
| Exterior: *brushed* | Rounding: *sub-rounded to angular* | *1624* | *1* | *MIX* | *4* |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Comments:<br>*Thick bodied, coarse temper visible to eye* | | | | | |

**Figure 5.** Example form, with sample answers given in italics. Adapted from ceramic MNV groupings from the Funston Avenue Archaeological Research Project, Presidio of San Francisco. (Form created by B. Voss, 1999, adapted by R. Allen 2010.)

group, adjusting as needed. Repeat steps 2 through 5 for each ware type in the ceramic assemblage.

Although it is not strictly necessary, cross-mending analysis is also recommended while determining MNV groupings. In cross-mending, analysts look for sherds that directly mend together, providing incontrovertible evidence that these sherds were once part of the same vessel. Cross-mending can provide greater precision in evaluating vessel form and vessel size. The distribution of cross-mended sherds within and between excavation units, stratigraphic layers, and archaeological features can also provide valuable information about depositional and post-depositional processes.

Sections below describe recording procedures for MNV attributes. It is not necessary to record all attributes for each MNV group. Rather, the ceramic analyst should thoughtfully consider which attributes will be most meaningful in determining MNV groupings for each ware type and which attributes will be most useful in addressing research questions related to the assemblage as a whole. Similarly, while this guide uses metric measurements, the ceramic analyst could select English measurements if preferred.

*Vessel Form*

Vessel form is one of the more relevant attributes related to interpretations of vessel function. Overall vessel form (Field No. 1 on the MNV recordation) can be recorded at one of three nested levels: at the most basic level, open or closed (as determined by orifice shape); second, flatware or hollowware; and third, whenever possible, specific vessel shape (e.g., bowl, cup, plate, or jar).

Additional form attributes recorded include rim form (Field No. 2), rim diameter (Field No. 3), base diameter (Field No. 4), vessel height (Field No. 5), and minimum and maximum thickness (Field No. 6). Rim and base diameters can be measured using the curve-fitting method (Rice 1987:223) to the nearest even-numbered centimeter (e.g., 2 cm, 4 cm, 6 cm, etc.). Unless more than 50% of the vessel is present (recorded in Field No. 7), curve fitting readings carry some ambiguity and the 2 cm interval best represents the level of accuracy that can be obtained. In cases where the diameter cannot be determined within a 2 cm interval, a range of diameters can be recorded (e.g., 12–18 cm).

*Vessel Manufacture*

Rice (1987:124) defines six procedures of vessel manufacture: pinching/drawing, slab modeling, molding, casting, coiling, and throwing. Each can leave characteristic marks on the vessel body and in the cross-section view of the vessel paste provided by the broken surfaces of ceramic sherds. These are noted when visible and described in Field No. 8. Surface qualities of the vessel that are related to manufacture are also sometimes recorded in Field No. 9, “Surface Treatment.”

*Surface Treatment and Decoration*

Surface treatments can be undertaken to change the functional characteristics of a vessel (e.g., to reduce porosity) and/or to alter its appearance. These can include smoothing, burnishing, glazing, slipping, rouletting, or any combination of these methods. Surface treatments are noted in Field No. 9 for both the interior and exterior of the vessel. Decorative treatments of ceramic vessels such as painting, transfer printing, or decals are closely related to surface treatments and are recorded in Field No. 10, again for both the interior and exterior surface of the vessels.

*Body Characteristics*

As noted above, body characteristics are standardized for most mass-manufactured ceramics and may not need to be analyzed in detail beyond identification of ware type. For locally produced and hand-formed ceramics, body characteristics are key variables that can differentiate sherds that may look identical at first glance but which represent multiple original vessels.

The body of each vessel consists of the mixture of clays, nonplastic chemically inert temper/inclusions, and flux, that together provide the vessel with structural integrity before, during, and after the firing process. At this stage of analysis only macroscopic attributes of the vessel body are recorded. This includes the body color (Field No. 11), which can be recorded for the vessel interior surface, interior margin, core, exterior margin, and exterior surface using the Munsell color system of hue, chroma, and value. Where applicable, color recordation also includes the colors of any surface treatments and decorative elements. If color variation is present, record multiple colors to represent the range of color present throughout the sherd and/or MNV. Because of the limitations of the Munsell color system for extremely light and extremely dark colors, the Munsell neutral value scale can also be used when appropriate.

Recording the color of the vessel body provides considerable information about the parent clay and manufacture conditions of the vessel. First, the general color of the fired body can indicate the type of clay used to prepare the vessel: primary, or residual clays possess a high iron content and when fired range in color from yellow to red, while secondary deposits of clay usually have a low ferrous content and a high organic content, yielding gray, black, white, and cream colors. The color of the body core also indicates whether the ceramic was fired in a reducing or oxidizing environment: a dark core can indicate that the vessel was fired in a reducing environment or was fired at too low a temperature, or for too short a period of time to completely oxidize the organic material present in the clay (Rice 1987).

The second vessel body attribute is the inclusions/temper present in the vessel (Field No. 12). These inclusions can occur naturally within the parent clay, can be inadvertently incorporated during vessel preparation, and/or can be intentionally added. To record the inclusions/temper of each vessel, cleaned sherd edges should be inspected under a binocular microscope at 10× to 40× magnification. The material, volume, particle size, regularity/sorting, and rounding can all be recorded. Inclusions/temper attributes are particularly useful in distinguishing between handcrafted vessels of similar outward appearance.

*Burning*

Evidence of burning is indicated by the presence or absence of soot residues, and can generate important information about vessel function and pre- and post-depositional transforms that may have affected the ceramic sherds. Burning (Field No. 13) is recorded for the interior, interior margin, core, exterior margin, and exterior of each vessel, and is noted as absent, partially present, or present.

Because burning occurs after vessel manufacture, burning alone should not be used to determine MNV grouping. Nonetheless, systematic recordation of burning can provide important information to interpret vessel use and post-use transformation. In general, burning on part or most of the exterior of a ceramic vessel may be a strong indication that the vessel was used in cooking. Soot on the interior of the vessel probably accumulated after discard; soot on the broken edges of ceramic sherds would indicate burning after breakage. Both interior and margin burning suggest incineration, either intentional or accidental, before or after deposition.

*Vessel Completeness*

Sherds composing a minimum-vessel group are enumerated in two fields: Field No. 14, "Cross-mended sherds," lists all sherds that have been physically mended together, allowing reconstruction of part of the vessel; and Field No. 15, "Other affiliated sherds," lists all unmended sherds that uniquely share the vessel's diagnostic attributes. Together the cross-mended and unmended sherds are examined with respect to the percentage of the vessel represented (Field No. 7). This is subjectively assessed to one of six ranges: 0–5%, 5–25%, 25–50%, 50–75%, 75–100%, and 100%.

It should be remembered that the percentage of the vessel present within a minimum-vessel grouping is almost certainly an underestimate of its actual completeness. While this practice ensures that only those sherds *uniquely* matched to each minimum vessel's description are included in the grouping, it undoubtedly artificially suppresses measures of vessel completeness.

## Conclusions

Both in the field and in the laboratory, MNV analysis yields more accurate archaeological evidence, and better represents and interprets the actual use of the artifacts. Further, MNV analysis is particularly useful for intrasite and intersite comparative studies because MNV counts provide some correction to the biases that can be introduced through depositional and postdepositional processes. While this technical brief focuses exclusively on ceramic specimens, the field and laboratory methodologies described here can be adapted to quantify other functional items such as glass containers and tablewares, metal canisters, and clothing parts such as buttons and shoes. Many of the MNV principles and techniques presented can also be adapted for other kinds of artifacts found in the historic archaeological record. As with ceramics, defining MNVs for these categories is deceptively simple, and better suited as the subject of other technical briefs.

Archaeologists sometimes perceive ceramic MNV analysis to be time consuming and expensive. It need not be so. Critical assessment of the range of ceramic attributes to be considered allows the field archaeologist or laboratory researcher to focus analysis on those characteristics that are most likely to identify the original vessels that generated the assemblage. Most importantly, MNV analysis brings archaeologists closer to understanding what objects were actually used by the historical communities being studied through their research.

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## REFERENCES

Chase, Philip G.
1985 Whole Vessels and Sherds: An Experimental Investigation of Their Quantitative Relationships. *Journal of Field Archaeology* 12(2):213–218.

Colton, Harold Sellers
1953 *Potsherds: An Introduction to the Study of Prehistoric Southwestern Ceramics and Their Use in Historic Reconstruction*. Northern Arizona Society of Science and Art, Flagstaff.

Miller, George L.
1986 Of Fish and Sherds: A Model for Estimating Vessel Populations from Minimal Vessel Counts. *Historical Archaeology* 20(2):59–85.

Orton, Clive, Paul Tyres, and A. G. Vance
2003 *Pottery in Archaeology*. Cambridge University Press, Cambridge, UK.

Rice, Prudence
1987 *Pottery Analysis: A Sourcebook*. University of Chicago Press, Chicago, IL.

Rye, Owen S.
1981 *Pottery Technology: Principles and Reconstruction*. Taraxacum, Washington, DC.

Shepard, Anna O.
1956 *Ceramics for the Archaeologist*. Carnegie Institution of Washington, Washington, DC.

Sinopoli, Carla M.
1991 *Approaches to Archaeological Ceramics*. Plenum Press, New York, NY.

Voss, Barbara L.
2002 *The Archaeology of El Presidio de San Francisco: Culture Contact, Gender, and Ethnicity in a Spanish-Colonial Military Community.* Doctoral dissertation, Department of Anthropology, University of California, Berkeley. University Microfilms International, Ann Arbor, MI.

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