A Note: Measuring Compactness as a Requirement of Legislative Apportionment

Author(s): Ernest C. Reock, Jr.

Source: *Midwest Journal of Political Science*, Feb., 1961, Vol. 5, No. 1 (Feb., 1961), pp. 70-74

Published by: Midwest Political Science Association

Stable URL: https://www.jstor.org/stable/2109043

ERNEST C. REOCK, JR.
Rutgers University

A NOTE:

Measuring Compactness as a Requirement of Legislative Apportionment

THE PUBLICATION of 1960 census data has focused attention once more upon the problems of legislative apportionment. Many state legislatures are faced with the task of redrawing congressional district lines. In most states, legislative districts require attention as the population shifts of the past decade are documented with census statistics.

The three requirements of districting most frequently given lip service are population equality, contiguity, and compactness. At one time all three were included as statutory requirements on the federal level.[1] In recent years attempts have been made to restore them as a legal prescription for the establishment of congressional districts.[2] In the states, population equality, contiguity, and compactness are among the standards most frequently required of legislative districts by constitutional provisions.[3]

Population equality is easily measurable, and contiguity may be established by glancing at a map. The third requirement—compactness—however, remains subjective in that no method of measurement has gained general acceptance. Upon occasion the courts have grappled

[1] 31 *Stat.* 733 (1901).

[2] President Truman in 1951 urged Congress to re-establish such standards as population equality, contiguity, and compactness as requirements for congressional districts. See U.S. Congress, House of Representatives, *Standards for Congressional Districts (Apportionment)*, Hearings before Subcommittee No. 2, Committee on the Judiciary, House of Representatives, Eighty-sixth Congress, First Session on H. R. 73, 575, 8266, and 8473, June 24 and August 19, 1959 (Washington: Government Printing Office, 1959), pp. 29-31. Bills introduced to carry out the President's recommendations have had little success. The hearings cited constitute the most recent review by Congress of the subject. (Hereafter cited as *Hearings*.)

[3] As of the end of 1958, the apportionment of 73 of the 95 state legislative houses then in existence was required by constitutional provision to be on the basis of population in one form or another. Sixty-seven houses utilized districts, as contrasted with those in which representation was distributed among existing government subdivisions. Of the 67, in 47 the districts were required to be formed of contiguous territory, and in 20 the constitution called for compact districts.

with the problem, using such devices as the ratio of length to width and the number of sides of a district.[4]

Generally, compactness is thought of in purely geographic terms, as the district is shown on an outline map. It is in this sense that compactness will be considered here. Such concepts as the "compact and convenient" phrase of the New York state constitution would introduce another element.

The principal purpose of requiring that districts be compact is as a check upon gerrymandering. If specified standards of compactness must be met, many efforts to establish gerrymandered districts may be placed at a disadvantage. Without some requirement of compactness, the boundaries of a district may twist and wind their way across the map in fantastic fashion in order to absorb scattered pockets of partisan support.

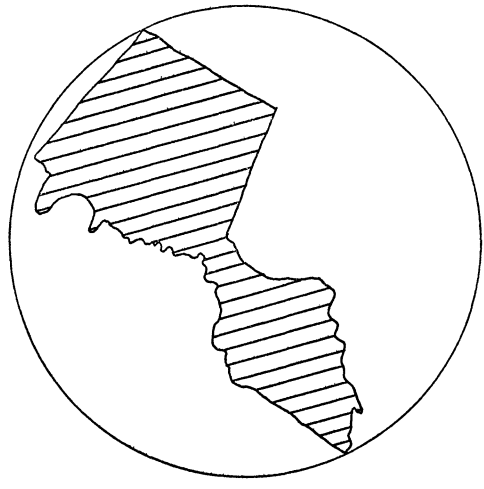
If compactness is to be required of congressional and legislative districts, the development of some method for measuring the results seems highly desirable. A relatively simple method is available. The most compact plane figure is the circle, for here the maximum area is enclosed within a given perimeter. The circle, therefore, can be used as the ideal of compactness, just as the average district population is used as the ideal of population equality. The degree of compactness of any district may be measured by the relationship between the area of the district and the area of the smallest possible circumscribing circle. An example is shown in Figure 1, using Passaic County, New Jersey—a legislative constituency—as an illustration. The area of the county is 202 square miles; the area of the smallest possible circumscribing circle is 670 square miles. The degree of compactness is found by dividing 202 by 670 and expressing the result as a percentage, in this case, 30.1%.[5]

[4] See for example *In re Timmerman*, 100 N.Y.S. 57, 51 Misc. Rep. 192 (N.Y. Sup. 1906). The ratio of east-west measurement to north-south measurement, a variation on the length-width rule, has been suggested by Professor Joseph E. Kallenbach of the University of Michigan, *Hearings*, p. 64.

[5] A question may arise as to how the center of the smallest possible circumscribing circle may be located. In most cases, the center will be at the mid-point of the longest dimension of the district. In a few instances, the irregularity of the district causes the center to be off-set somewhat from this point. In such cases, the center may be found by establishing a triangle formed by the farthest extremities of the district and finding the center of a circle drawn through the points of the triangle. The center of this circle is at the point where the perpendicular bisectors of the sides intersect. It may be necessary to establish two or three successive triangles in order to determine the three key points through which the circle should pass so that the district will be completely circumscribed.

In order to establish some perspective in evaluating the degree of compactness, a total of 252 districts in six state legislative houses have been measured. The distribution of the results is shown in Table 1.

FIGURE 1: DEMONSTRATION OF PROPOSED PROCEDURE FOR DETERMINING DEGREE OF COMPACTNESS—PASSAIC COUNTY, NEW JERSEY



Area of County = 202 square miles
Area of Circle = 670 square miles
Degree of Compactness = 202/670 = 30.1%

TABLE 1: DEGREE OF LEGISLATIVE DISTRICT COMPACTNESS IN SELECTED STATES

State	House	Number of Districts	Degree of District Compactness									
			0.0-10.0	10.1-20.0	20.1-30.0	30.1-40.0	40.1-50.0	50.1-60.0	60.1-70.0	70.1-80.0	80.1-90.0	90.1-100.0
Alabama	Upper	35			4	7	12	7	5			
Colorado	Upper	25			1	3	6	11	4			
Colorado	Lower	35			1	6	12	8	8			
Ohio	Upper	21			1	11	6	3				
Texas	Upper	31			3	7	12	6	2	1		
Texas	Lower	105			3	19	39	29	14	1		
6 Houses		252			13	53	87	64	33	2		

Taken together, the 252 districts average 47.1% and have a median degree of compactness of 47.2%. Individually, they range widely from a high of 71.3% for Bexar County in Texas, which forms both the

26th senatorial district and the 68th house district, to a low of 21.5% for Arapahoe County in Colorado, which is designated as the 10th house district.

Ninety congressional districts in ten states also have been analyzed for compactness. Here the degree of compactness varies from a low of 17.1% for Oregon's third district to a high of 82.6% for the fourteenth district in New Jersey. The distribution is shown in Table 2.

TABLE 2: DEGREE OF CONGRESSIONAL DISTRICT COMPACTNESS IN SELECTED STATES

State	Number of Districts	Degree of District Compactness									
		0.0-10.0	10.1-20.0	20.1-30.0	30.1-40.0	40.1-50.0	50.1-60.0	60.1-70.0	70.1-80.0	80.1-90.0	90.1-100.0
Colorado	4					3	1				
Connecticut	5*				1	2	1	1			
Georgia	10				1	4	3	2			
Kansas	6				1	4		1			
New Jersey	14			1	5	5	2			1	
Oregon	4		1			2	1				
Indiana	11			2	2	6		1			
Mississippi	6			1	2	1	2				
Tennessee	9				2	5	2				
Texas	21*			1	6	8	2	3	1		
10 States	90		1	5	20	40	14	8	1	1	

* In addition, Connecticut and Texas each elects one congressman at large.

The average degree of compactness for the ninety districts is 46.4% and the median is 45%.

The samples of legislative and congressional districts which have been cited should not necessarily be considered representative. The states were selected, to some extent, on the basis of geographic distribution. More important in their choice, however, was the availability of information upon which to base the analysis. The practice, in most of these states, of following county boundaries in the delineation of districts was most helpful.

Perhaps the logical concluding step in this discussion should be recommendations for statutory provisions requiring each district to meet at least a minimum standard of compactness. This is the approach taken with regard to population equality; a maximum relative deviation is proposed—sometimes 10, sometimes 15, sometimes 20%. Such a step is not desirable for compactness. In states such as Oklahoma or Maryland, with sparsely populated "panhandles," some districts must

inevitably lack compactness. The same holds true for maritime states with heavily indented coastlines and numerous off-shore islands. Furthermore, other apportionment standards may well take precedence, with population equality heading the list.

Probably the best use for the method of measuring compactness outlined here is as a tool for the courts and as a weapon for public opinion. Given a statutory or constitutional directive that districts be "as compact as is practicable," the mathematical degree of compactness may be used to test the reasonableness of any districting act. In individual situations other requirements—population equality, contiguity, even adherence to county or municipal boundaries—may dictate the formation of a particular non-compact district. Where such considerations are not overriding, however, districts should be required to meet a reasonable standard of compactness. On the basis of the districts examined here, it seems reasonable to say that every district with a degree of compactness of less than 30% should be re-examined carefully. Districts having a degree of compactness below 20% should be considered suspect until proven valid.