



Bell Laboratories

subject: North American Numbering Plan -
The First Thirty Years -
Historical Review of Numbering
Plan Area (NPA) Code Assignments -
File 40978

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MEMORANDUM FOR FILE

Major decisions in the formulation of a comprehensive telephone numbering plan for North America date from about 1945. The first official map of specific assignments appeared in 1947. At that time 86 geographic divisions of Canada and the contiguous United States took on 3-digit identities and became charter members in the domain of area codes. Coverage now extends to Alaska (907), the Caribbean (809), Hawaii (808), and parts of Mexico (903 and 905). Services requiring special area codes such as TWX and Inward Wide Area Telecommunications Service (Area Code 800) have also been introduced. The present count of area codes assigned stands at 131. This memorandum, largely by reference to illustrative maps, briefly reviews the assignment history of the 45 codes which have joined the original 86 to produce the current total. The memorandum also examines forecasts relating to the probable exhaust date of the 152 codes which satisfy today's standard format (viz., NOX and NLX except N11, where N is any digit from 2 through 9 and X is any digit.). Subsequent to the "152" exhaust date, the first "interchangeable" area code, most probably code 260, will be assigned when growth requirements justify expansion beyond the "152" barrier. This is not expected to be necessary until about the year 2000.

The optimum relationship between political boundaries and area code boundaries is not obvious. Clearly many advantages accrue if a natural relationship exists, but the associated constraints imposed should not interfere with the fundamentals of effective numbering. Accordingly, early studies sought convenient boundaries within which comparable numbers of telephones existed or were anticipated. Map No. 1, attached, shows an early effort wherein 60 divisions of the United States are identified but not yet numbered.

Canadian provinces were considered separately. This map was published in the Bell Labs Record, October 1945, (Vol. 23, No. 10) as part of an article by F. F. Shipley entitled "Nation-wide Dialing." Political boundaries were key building blocks but the unique association of a given area code with one particular state was not yet a characteristic of the plan. The concept of common numbering for a cluster of political entities was later revived when the Caribbean was labeled with Code 809.

The need for the assignment of a specific number to the geography within each numbering plan area (NPA) boundary offered new opportunity for decision making. How many digits should be assigned? Would a format structure facilitate their recognition, both by customers and switching equipment? These and related questions were considered at length. The result was dictated by practical compromise. Capacity for one to two hundred area codes appeared to be a long term requirement. Two decimal digits were enough to satisfy minimal objectives, but a structure offering a means of ready recognition would then be lacking. The outcome was a decision to use three digits with the middle digit either zero or one. This structure provided for easy machine recognition of area codes and offered a capacity of 152 (NO/lX less N11).

Consideration then shifted to specific numerical assignments. Perhaps some assignment pattern would yield benefits. It was recognized, for example, that large cities would attract large volumes of toll traffic. With rotary dials the time needed to dial area code 212 is less than half the time needed to dial 909. This would be a factor in the economics of register holding time. Accordingly, "short" NPA codes 212, 213 and 312 were assigned to New York, Los Angeles and Chicago, respectively. Several other large cities (e.g., Dallas - 214, Philadelphia - 215, Cleveland - 216, Detroit - 313, St. Louis - 314, Pittsburgh - 412, Milwaukee - 414, Oakland-San Francisco - 415, Toronto - 416, and Montreal - 514) also received "short" assignments, with the same end in view.

When the concept of the area code was new, there was considerable concern about the ability of operators and customers to cope with long number sequences. Assignment patterns seemed to be a possible help. Thus in Map No. 2, a tentative issue never officially released, there can be seen a deliberate effort to group similar numbers. In Canada, for example, the area codes invariably were to begin with the digit 9 and were to be so arranged that in a number of cases adjacent numbers covered adjacent provinces. In large states with multiple area codes, similar

natural groupings of codes having sequential characteristics were formed. After due consideration, this concept of assignment patterns was dropped. Too little was yet known about telephone growth distribution. This uncertainty threatened the adequacy and stability of initial assignment patterns. It was foreseen that ultimate departure from an established pattern would provoke both confusion and criticism. Since the available supply of codes could not cover all contingencies involving future requirements for pattern extension, it was decided to avoid patterns. Maryland and Delaware (301 and 302) and Wyoming and Nebraska (307 and 308) are apparent exceptions but the intent of essentially random assignments is clear.

One not so obvious element of code structure in the tentative plan was incorporated in the first official plan. Specifically, any state fully covered by a single area code would be given a code with the middle digit "0." Thus, Maine and Connecticut, for example, were assigned 207 and 203 respectively. A state requiring multiple area codes would always be given codes with "1" as the middle digit. The intent was to aid operators in associating a unique code with its corresponding full state. Once an operator memorized any or all of the NOX code assignments, it became possible to dial directly to such states, given only that the originating party knew the state and the 7-digit local number. The destination city was no longer a consideration. Except where single-NPA states in 1947 have since been assigned one or more new codes, this assignment characteristic is still visible. Specifically, every state covered by one area code (25 states plus the District of Columbia) has zero as the middle digit of that area code. Where Canadian provinces are covered by a single code, the same assignment practice can be noted.

The first official issue of the North American numbering plan area map appeared in 1947. See Map 3. Initially 86 assignments were shown. Almost immediately it was decided to assign a separate code (202) to the District of Columbia, rather than include it with Maryland (301). The Bell Labs Record issue of January, 1949, page 29, shows this early status, although the caption misstates the code total as 83 when in fact the map depicts 87. The District of Columbia assignment is shown on Map 4, along with a reconfiguration of the NPA boundaries in California.

The area code total then remained constant for about 3 years. Map 5, effective on December 31, 1950, featured the next new assignment (NPA 417) in Missouri, with other Missouri boundaries suitably adjusted. About a year later in January, 1952, Map 6 appeared, bringing two more codes with it. Long Island (NPA 516) and California (NPA 714) were the beneficiaries, raising the code total to an even 90. At this point the growing significance of North American numbering was highlighted in a BSTJ article (Vol. 31, May, 1952) with an accompanying status map illustrating the 90 assignments. Map 7 reflects 2 years of growth. Now the total became 94 with new entries in Ontario, Canada (519), Florida (813), Oklahoma (918) and Texas (817). By the end of 1954 there was still more change. Five fresh codes pushed the total to 99. Map 8 shows the new entries: Georgia (912), Minnesota (507), New York (607) North Carolina (919) and Tennessee (615). The next year saw the assigned total pass the century mark, reaching 103. New Brunswick, Canada (506), Kentucky (606), Nebraska (308) and Wisconsin (608) were the recipients as shown on Map 9. Over the last 2 years of the first decade the rate of new assignments attained the level of five per year. Thus at the end of 1957 Map 10 shows ten new assignments. There were now 113 codes assigned, 100 for the United States and 13 for Canada. For the first time new geography was covered, viz. Alaska and Hawaii. The assignments were as follows: Canada: Ontario (705), ~~Ontario~~ (819); United States: Alaska (907), California (805), Hawaii (808), Illinois (309), Louisiana (318), New Jersey (609), Texas (806) and Washington (509).

Quebec

The second decade of numbering was marked by clear conservation trends. Map 11, effective near the end of 1958 added a code in California (209) and for the first time went beyond the boundaries of the U.S. and Canada to provide Caribbean coverage. Code 809 was assigned to cover Bermuda, Puerto Rico, the Virgin Islands and any of the many islands of the Caribbean that might wish to acquire a "North American" telephone identity. Map 12 appeared at the end of 1959 and again featured California, this time with two codes (707 and 408). In addition the divisions within Kentucky and North Carolina were arranged to minimize cross boundary calling difficulties. Map 13 carried the plan into 1961, giving Michigan's northern peninsula its own code (906). For several years prior to this addition the boundaries of code 517 and 313 within Michigan had also been changing. The map shows the new code and the result of the reconfiguration. The code total was now 118.

By the end of 1962 three more assignments were introduced, all covering territory outside the United States. See Map 14. Canada's total went from 13 to 15, where it still remains, with codes 807 and 709 for Ontario and Newfoundland respectively. The other code set a precedent by providing coverage in northwestern Mexico. Code 903 was assigned in part to encourage integration of Mexico's numbering with the rest of North America. This goal was not achieved, however, and compatibility remains a problem although another special arrangement later gave access to Mexico City, Federal District. The code total for telephones was now 121, a figure no longer comfortably distant from the 152 capacity limit. Meanwhile, at Bell Laboratories work was progressing on plans for interchangeable code usage. The well known (to numbering planners) "SEP 65" was issued in 1962 to provide for the expansion of area codes beyond 152 and of office codes beyond 640 to a new combined total of 792. The dominant concern was area code exhaust, which appeared probable in the mid-1970s if consumption rates were not curbed. Tables 1 and 2 summarize the history of code assignments and show exhaust forecasts based on direct year-by-year extrapolation of past usage. ←

In addition to the typical area codes considered above, 1962 saw the advent of the special area code or SAC. Four such codes (510, 710, 810 and 910) were provided for TWX service in the U.S. and another (610) was assigned to Canada. Map 15 shows the coverage. Code 510 was used to number 4-row TWX stations on the DDD network in the U.S. Code 610 was the Canadian counterpart. Other 4-row TWX customers were served on a special network and were identified by the other three codes indicated. Customers with 3-row TWX stations were given addresses comparable to DDD voice customers.* The assigned code total had reached 126. It was now fifteen years from the 1947 start date. Assignments had grown from 86 to 126, an increase of 46 percent. There remained only 26 more NO/1X type codes.

At this critical time the attention which had been focused on code resources had the salubrious effect of promoting code conservation. Requests for codes now had to be

* TWX service in the U.S. has subsequently been sold to the Western Union Company. When TWX is no longer carried on the Bell System toll network, codes 510, 710, 810 and 910 will be recovered for later use in other service applications.

accompanied by more persuasive evidence of justification. The result was a dramatic change in the rate at which assignments occurred. This is not to say that new codes could not be obtained. In 1965 Florida was split three ways with code 904 appearing in northern Florida. Map 16 indicates this change. In 1966 a new service offering called Inward WATS (Wide Area Telecommunications Service) required a code. The first of the double-0 codes, 800, was introduced to meet this unorthodox need. In 1969 traffic to Mexico City had reached a level where dial service became attractive. Despite the basic incompatibility in numbering plans the 8-digit Mexico City addresses (format 5NXXXXXX) were made to fit U.S. - Canadian patterns by means of code 90(5) where the (5) is to call attention to the dual use of the third digit to produce a 10-digit code with standard structure, i.e., 90 + "8D" or 905 + "7D."

In 1971 network managers found that prearranged TV telethons and other events involving mass calling could be dealt with more effectively if callers revealed themselves at originating class 5 offices by using code 900 with a special 7-digit number following. (Since this code application was carefully controlled and had only short term effects, the assignment was approved with the understanding that the short term network management use could yield to a greater need whenever necessary.) Finally in 1972 the state of Virginia was split, with code 804 covering the southeast and the existing code 703 remaining in effect opposite the District of Columbia and along the northern border to the west. Map 17 illustrates the current status in Virginia. There have been no new assignments since Virginia. None are imminent. Map 18 is a summary map which highlights the changes since 1947. Original area code assignments in states not requiring code relief are shown in white. New codes are shown shaded. Areas shown crosshatched denote original codes in states which have required code relief.

What then is our present status? A capsule summary is offered below:

Assignments in 1947:	86 (66 spare)
Canadian telephone	9
U.S. telephone	77
Assignments in 1975:	131 (21 spare)
Canadian telephone	15
U.S. telephone	106

(Continued next page)

Assignments in 1975: (Cont'd)

Inward WATS	1
Mass Calling	1
Mexico	2
Caribbean	1
Canadian TWX	1
U. S. TWX	4

Tables 3 and 4 give current assignments in numerical and alphabetical order respectively.

The review of the numbering plan presented above answers some questions while raising others. The more important new questions relate to the future. Which codes will exhaust next? What steps are being taken to prepare for future needs. In this regard the A.T.&T. Co. has instituted a Central Office Code Utilization Survey (COCUS) which provides a current data base on which sound analysis can be based. The reader is referred to COCUS for the most current view of the road ahead.

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Atts.
References
Tables
Maps 1-18

REFERENCES

1. Bell Labs Record, October, 1945, "Nationwide Dialing".
2. Bell Labs Record, January, 1949, page 29.
3. BSTJ, Vol. 31, May, 1952.
4. Bell Labs Record, January, 1954.
5. Bell Tel. Magazine, Winter, 1954-55, page 240.
6. Bell Tel. Magazine, Summer, 1955, page 108.
7. Fortnightly Telephone Engineer, March, 1956.
8. Dist. Dialing Coordinating Handbook, February, 1959 and later.
9. Notes on Distance Dialing 1961.

* Informationally not listed because a error in content:
Bell Tel Magazine, Winter 1959-60, page 0
by William A. Sinks

NPA CODE ASSIGNMENT HISTORY

	00	01	02	03	04	05	06	07	08	09	10	12	13	14	15	16	17	18	19
2	S	x	47	x	\bar{x}	x	x	x	x	58	S	x	x	x	x	x	x	x	x
3	S	x	x	x	x	x	\bar{x}	x	55	57	S	x	x	x	x	x	x	57	x
4	S	x	x	\bar{x}	x	x	x	S	59	S	S	x	x	x	x	\bar{x}	50	\bar{x}	x
5	S	x	x	x	x	x	$\bar{55}$	54	S	57	$\bar{62}$	x	x	\bar{x}	x	51	x	x	$\bar{53}$
6	S	x	x	x	\bar{x}	x	55	54	55	57	$\bar{62}$	x	\bar{x}	x	54	x	x	x	S
7	S	x	x	x	x	$\bar{57}$	S	59	S	$\bar{62}$	$\bar{62}$	x	x	51	x	x	x	S	S
8	$\bar{66}$	x	x	x	72	57	57	$\bar{62}$	57	$\bar{58}$	$\bar{62}$	x	53	x	x	x	53	S	$\bar{57}$
9	$\bar{71}$	x	\bar{x}	62	65	$\bar{69}$	61	57	S	S	$\bar{62}$	54	x	x	x	x	S	53	54

Legend:

S = Spare Code

57 = Approx. Year End Marking Transition
from Spare to Given Assignment

$\bar{57}$ = As above but Assignment is for Canada

$\bar{66}$ = As for basic number, but a special purpose
assignment is denoted.

$\bar{62}$ = As above, but a special purpose assignment
for Canada is denoted

x = Original assignment (U.S.)

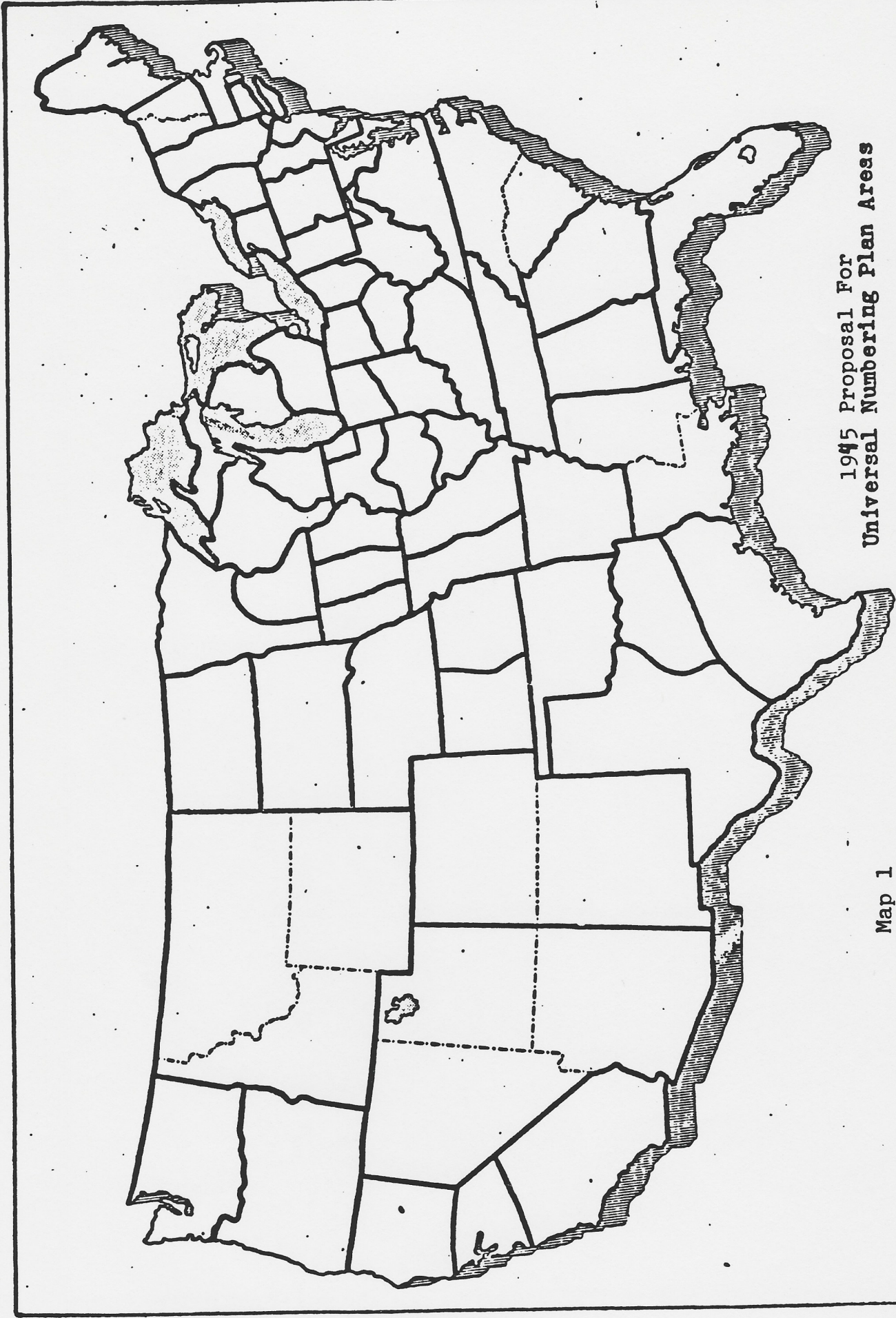
\bar{x} = Original assignment (Canada)

TABLE 1

TABLE 2.

In Calendar Year	Predicted Exhaust Year	Yrs. Lead Time
1947	2012	65
1948	2078	130
1949	2144	195
1950	2078	128
1951	2028	77
1952	2045	93
1953	2004	51
1954	1987	33
1955	1981	26
1956	1985	29
1957	1973	16
1958	1973	15
1959	1974	15
1960	1976	16
1961	1977	16
<u>1962</u>	<u>1972</u>	<u>10</u> (min.)
1963	1974	11
1964	1976	12
1965	1977	12
1966	1977	11
1967	1979	12
1968	1980	12
1969	1981	12
1970	1983	13
1971	1983	12
1972	1984	12
1973	1986	13
1974	1987	13
1975	1988*	13*

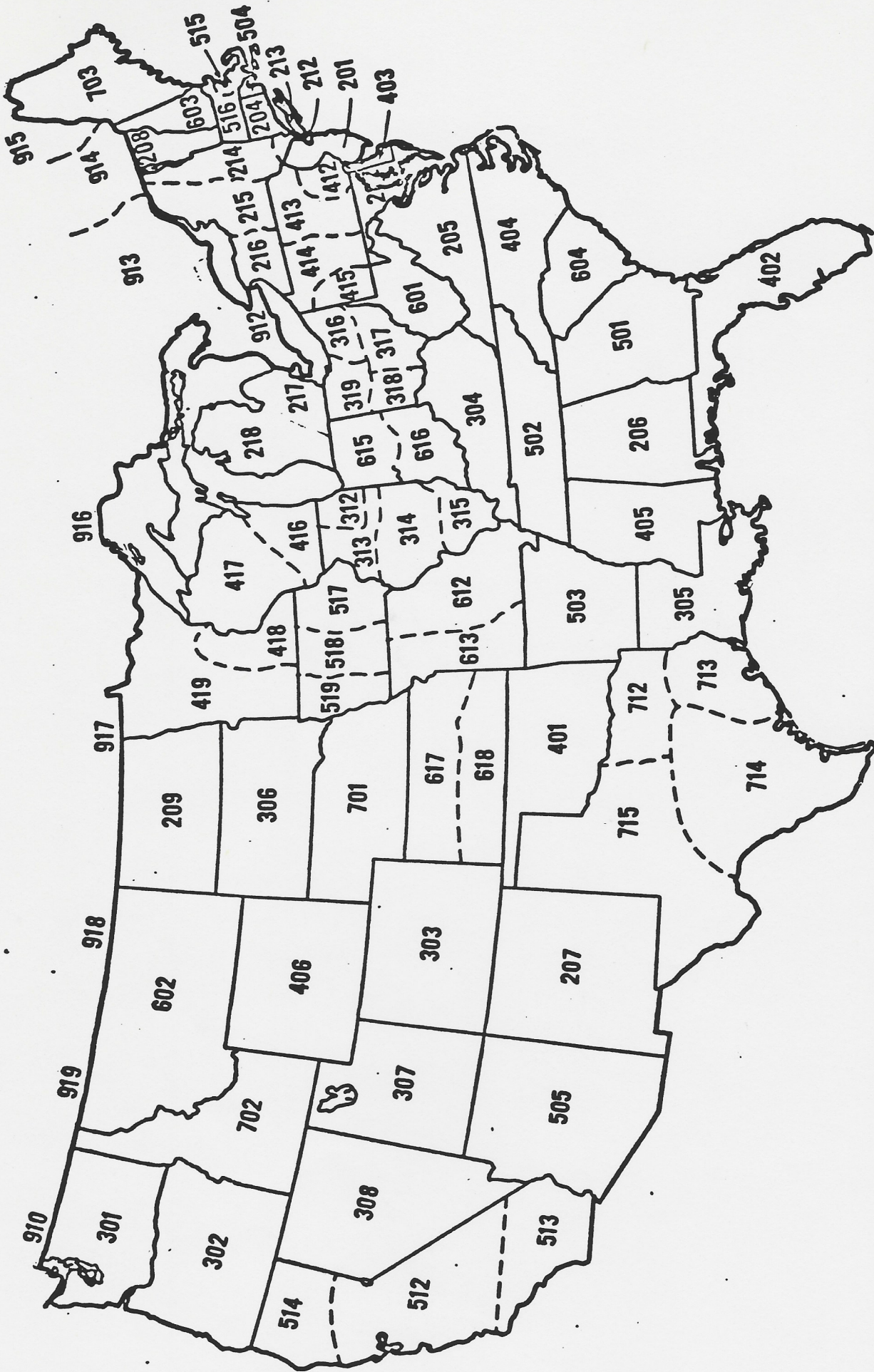
* Corrected for codes expected to be recovered and other forecasting information these numbers fall in the range 1995-2000 and 20-25.



1945 Proposal For
Universal Numbering Plan Areas

Map 1

Early 1947 - Tentative Assignments



October 1947 - First Official Issue - 86 Codes

