Fields:
CBG
AREA EMPTY
AREA LAND
% EMPTY

7. Single Line Business Table

To determine the number of single-line businesses in each CBG, company size data from Dun & Bradstreet were applied to a employees per phone line distribution drawn from BusinessWave. BusinessWave data were derived from a sample of 3,414 small and medium sized firms (from 26 states) with sales under $10 million.

Dun & Bradstreet supplied information by CBG regarding the number of firms that had employee counts in the following ranges:

1 employee	1 l-24 employees
2 employees	25-49 employees
3 employees	50-99 employees
4 employees	100-249 employees
5 employees	250-499 employees
6 employees	500-999 employees
7 employees	1 000+ employees
8 employees	
9 employees	
10 employees	

This was compared against the following BusinessWave data:

Employee Size	*Probability of Single Line Business %*
1	44.7%
2	37.2%
3	26.8%
4	17.1%
5	26.0%
6	13.2%
7-g	24.2%
9-12	11.3%
13+	6.2%

The result was a breakdown of the number of single-line business lines within in CBG.

Fields:
CBG
SINGLE LINE BUSINESS LINES

8. V&H Coordinates Table

PNR and Associates provides the latitude and longitude of the centroid of each CBG. These data were used to determine the Vertical and Horizontal (V&H) coordinates of the CBG's centroid. The database uses the V&H coordinates of the CBG and of the wire center to calculate the distances and angles.

Fields:
CBG
CBG-VERT
CBG-HORIZ

9. Wire Center Table

This table associates each wire center with its V & H, operating company number (OCN), company and group. The OCN value has a two digit state code appended to the original four digit OCN code, making the six digit state code unique across states. The group categories are listed below.

Group No.	Description
1	Non-RBOC Large Tier 1 (GTE/CONTEL and SPRINT/CENTEL)
2	All other companies that file ARMIS
3	Greater than 50,000 lines nationwide, but that do not file ARMIS
4	Less than 50,000 lines nationwide (do not file ARMIS)
8	RBOC and SNET

The table contains the following fields:

Fields:
STATE
CLLI (WC)
WC-VERT
WC-HORIZ
OCN
COMPANY
GROUP

II. HM 3.0 Input Issues

1. HM2.2.2 Swap

Issue

Certain CBGs may be mapped to extremely distant wire centers, even when other wire centers are substantially closer. For example, this could occur if a large Centrex customer in the CBG is served out of a distant wire center. To avoid the costing of inefficiently long loop feeder runs, the wire center that PNR assigns to those CBGs to is replaced with the I-Ih32.2.2 wire center--based on the criteria described below.

Action

If the PNR wire center to CBG radial distance is greater *than* 1.5 *times the HM2.2.2* distance *and* is greater than 10,000 ft., the HM2.2.2 wire center assignment is used instead.

2. Actual Zero Lines

Issue

Occasionally, CBGs contain a zero number of lines.

Action

If the number of firms and the number of households is also zero, those CBGs are removed from the dataset.

3. Adjusted Zero Lines

Issue

CBGs are reported with zero lines, but the CBG contains households or businesses.

Action

Calculate a new number of lines for the CBG using the following method:

1. Residential lines = No. of Households x (% line penetration x (1 + % second line))
2. Business lines = Employees x 0.504547

Note: 0.504547 is the nationwide average of business lines per employee.

4. Census Data Error

Issue

Census data provide no information about housing type in certain CBGs where households exist.

Action

Assume the housing types in these CBGs to be single-family, detached homes,

5. State Swap

Issue

Some CBGs are assigned to wire centers that are in a state that neighbors the CBG's state.

Action

These CBGs are removed from the state's dataset and will be associated with the dataset for the neighboring state.

6. CBG with Zero Area

Issue

Occasionally, CBGs are reported with zero area, but the CBG contains households or businesses.

Action

Calculate a new area for the CBG, then adjust the density (lines/sq. mile) using the following equation:

1. New area = 0.000386 x (No. of households + No. of firms)
2. New density = No. of total lines / new area.

Note: 0.000386 is the square mile equivalent of a 10,000 square foot lot.

7. Percent Empty Calculation

Issue

Occasionally, a CBG is reported to be 100% empty, but the CBG contains households or businesses.

Action

Substitute a new percent empty for each CBG, according to the following rules.

1. If the total area of CBG is less than 0.5 square miles, adjust the percent empty to zero.

2. If the total area of the CBG is greater than 0.5 square miles, the new percent empty was calculated by the following equation:

$$1 - \frac{(0.000386 \times (\text{No. of households} + \text{No. of firms}))}{\text{Area of CBG}}$$

Note: 0.000386 is the square mile equivalent of a 10,000 square foot lot.

8. Errors Tab

Issue

CBG may contain an unreadable CLLI code.

Action

Remove CBG.

9. Adjusted OCN

Issue

Occasionally, the wire center was mapped to the incorrect company.

Action

The correct company name, group number and OCN for the wire center in question was applied to the dataset.

IO. Unrecognized CLLI

Issue

Occasionally, a wire center or CLLI in the LERG has not been mapped to any CBG in the HM 3.0 dataset, or the PNR data includes a wire center that is not listed in the LERG.

Action

These wire centers have been removed from the dataset and documented.

III. HM 3.0 Inputs Field Descriptions

Field	*Description*
STATE:	State Code
CLLI:	8 Digit CLLI
COMPANY:	Company Name
OCN:	digit OCN for each company - at present unique by state. Next set f data will be unique across all states and a 2 digit state code will be dded to the OCN
GROUP:	=NonRBOC Large Tier 1 (GTE/CONTEL and SPRINT/CENTEL) =All other companies which file ARMIS =Greater than 50,000 lines nationwide and do not file ARMIS =Less than 50,000 lines nationwide and do not file ARMIS =RBOC and SNET
CBG:	Total geo-code
QUAD:	Quadrant where the centroid of the CBG falls CLLI
ALPHA:	Angle CLLI
OMEGA:	Angle CLLI
DISTANCE:	Distance between centroid of the Wire Center and the centroid of the CBG CLLI
AREA:	CBG area including land and water
% EMPTY:	% of area of the CBG with no lines (% of empty land + water)
DENSITY:	Total Lines per square mile
ROCK DEPTH:	Data from HM2.2.2
SURF TEXT:	Data from HM2.2.2
ROCK HARD:	Data from HM2.2.2
WATER TABLE:	Data from HM2.2.2
TOTAL LINES:	Sum of Bus., Res., Special, and Public lines
BUS LINES:	Total Business lines in a CBG (normalized by applying company specific factor to adjust to ARMIS 4308)
RES LINES:	Total Residential lines in a CBG (normalized by applying company specific factor to adjust to ARMIS 4308)
SPECIAL LINES:	Total Special lines calculated by applying a state and company specific factor to the adjusted business lines
PUBLIC LINES:	Total Public lines calculated by applying a state and company specific factor to the adjusted public lines
SINGLE LB:	Number of SLB in each CBG (normalized by applying company specific factor to adjust to ARMIS 4301)
HOUSEHOLDS:	Households per CBG
HU-1 DETACH:	1 unit structure detached from any other (all housing types include occupied and vacant)

Field	*Description*
HU-1 ATTACH:	1 unit structure attached to other structures
HU-2:	structure containing 2 units
HU-4:	Structure containing 4 units
Hu 5-9:	Structure containing 5-9 units
HU 10-19:	Structure containing 10-19 units
HU 20-49:	Structure containing 20-49 units
HU 50+:	Structure containing more than 50 units
MOBILE:	Mobile home or trailer
OTHER:	Any other
FIRMS:	Firms in a CBG (does not represent locations)
EMPLOYEES:	Employees in CBG
WC DIST. CHANGE:	If this field contains an "X", the Wire Center provided by PNR was replaced with the Wire Center mapped to this CBG in HM2.2.2. This will occur only if the radial distance calculated using the PNR Wire Center is greater than 10,000 ft. *and* more than 1.5 times the distance indicated in HM2.2.2 (Note: HM2.2.2 uses the BCM-PLUS convention of mapping Wire Centers to the closest CBG in radial distance.)

TAB 3

Hatfield Model Release 3.0

Appendix B

Inputs and Assumptions

Appendix B

Hatfield Model Release 3.0

Inputs and Assumptions

Loop Distribution

Adjustments for Long loops

Loading Investment per Line

DEFINITION

The investment required to add loading coils at distances beyond 18,000 ft.

DEFAULT VALUE

Ranges from $20.00 at 15,000 feet to $175.00 at 178,000 feet.

Loading Investment per Line	
Distance	Adjustment
1	0
16,000	20
27,000	40
55,000	75
99,000	110
176,000	175

Cable Gauge Multiplier

DEFINITION

Multiplier of the material portion of the per foot cable investment to reflect the need for coarser gauge cable to accommodate long loops.

DEFAULT VALUE

Ranges from 1.36 at 18,000 feet to 13.07 at 178,000 feet.

Cable Gauge Multiplier	
Distance	Adjustment
1	1
18,000	1.36
27,000	2.55
55,000	2.55
99,000	13.07
176,000	13.07

DLC Channel Unit Adjustment

DEFINITION

The increase in investment required for a DLC channel unit that can drive increased current through loops longer than 55,000 feet.

DEFAULT VALUE

Distance	Adjustment
1	1
18,000	1
27,000	1
55,000	1.25
99,000	1
178,000	1.25

Fill Factors/Utilization

Input Parameters

Distribution Cable Fill Factors

DEFINITION

The spare or excess capacity in a distribution cable, calculated as the ratio of the number of assigned pairs to the total number of available pairs in the cable.

DEFAULT VALUES

Density Zone	Fill Factor
0-5	.50
5-100	.55
100-200	.55
200-650	.60
650-850	.65
850-2,550	.70
2,550-5,000	.75
5,000-10,000	.75
10,000+	.75

Copper Feeder Cable Fill Factors

DEFINITION

The spare or excess capacity in a feeder cable, calculated as the ratio of the number of assigned pairs to the total number of available pairs in the cable.

DEFAULT VALUES

Density Zone	Fill Factor
0-5	.65
5-100	.75
100-200	.80
200-650	.80
650-850	.80
850-2,550	.80
2,550-5,000	.80
5,000-10,000	.80
10,000+	.80

Structure and Structure Fractions

Drop Parameters

Drop Structure Fractions

DEFINITION

The percentage of drops that are aerial and buried, respectively, as a function of CBG density zone,

DEFAULT VALUES

Density Zone	Aerial	Buried
0-5	.50	.50
5-100	.50	.50
100-200	.50	.50
200-650	.50	.50
650-850	.50	.50
850-2,550	.30	.70
2,550-5,000	.30	.70
5,000-10,000	.60	.40
10,000+	.90	.10

Distribution Parameters

Distribution Structure Fractions

DEFINITION

The relative amounts of different structure types supporting distribution cable in each density zone. Aerial distribution cable is attached to telephone poles or buildings, buried cable is laid directly in the earth, and underground cable runs through underground conduit.

DEFAULTS

Density Zone	[illegible]	[illegible]	[illegible]
0-5	.25	.75	0
5100	.25	.75	0
100-200	.25	.75	0
200-650	.30	.70	0
650650	.30	.70	0
850-2,550	.30	.70	0
2,550-5,000	.30	.65	.05
5,000-10,000	.60	.35	.05
10,000+	.85	.05	.10

Distribution Pole Spacing

DEFINITION

Spacing between poles supporting aerial distribution cable.

DEFAULT VALUES

Distribution Pole Spacing	
Density Zone	Spacing
0-5	250
5-100	250
loo-200	200
200-650	200
650-850	175
850-2,550	175
2,550-5,000	150
5,00610,000	150
10,000+	150

Copper Feeder Parameters

Copper Feeder Structure Fractions

DEFINITION

The relative amounts of different structure types supporting sheath feet of copper feeder cable in each density zone. Aerial feeder cable is attached to telephone poles, buried cable is laid directly in the earth, and underground cable runs through underground conduit.

DEFAULT VALUES

[illegible]			
Density Zone	[illegible]	[illegible]	[illegible]
0-5	.50	.45	.05
5-100	.50	.45	.05
100-200	.50	.45	.05

200-650	.40	.40	.20
650-850	.30	.30	.40
850-2,550	.20	.20	.60
2,550-5,000	.15	.10	.75
5,000-10,000	.10	.05	.85
10,000+	.05	.05	.90

Copper Feeder Manhole Spacing, feet

DEFINITION

The distance, in feet, between manholesforcopperfeedercable.

DEFAULT VALUES

Copper Feeder Manhole Spacing, feet	
Density Zone	Distance between manholes, ft.
0-5	800
5100	800
100-200	800
200-650	600
650-850	600
850-2,550	600
2,550-5,000	600
5,000-10,000	400
10,000+	400

Copper Structure Pole Spacing, feet

DEFINITION

Spacing between polessupportingaerialcopperfeedercable.

DEFAULT VALUES

Copper Structure Pole Spacing	
Density Zone	Spacing, ft.
0-5	250
5-100	250
loo-200	200
200-650	200
650-850	175
850-2,550	175
2,550-5,000	150
5,000-10,000	150
10,000+	150

Buried Copper Cable Sheath Multiplier (feeder and distribution)

DEFINITION

The additional cost of the filling compound used in buried cable to protect the cable from moisture, expressed as a multiplier of the cost of non-armored cable.

DEFAULT VALUE

1.04

Fiber Feeder Parameters

Fiber Feeder Structure Fractions

DEFINITION

The relative amounts of different structure types supporting sheath feet of fiber feeder cable in each density zone. Aerial feeder cable is attached to telephone poles, buried cable is laid directly in the earth, and underground cable runs through underground conduit.

DEFAULT VALUES

Density Zone			
0-5	.35	.60	.05
5-100	.35	.60	.05
100-200	.35	.60	.05
200-650	.20	.60	.20
650-850	.30	.30	.40
850-2,550	.20	.20	.60
2,550-5,000	.15	.10	.75
5,000-10,000	.10	.05	.85
10,000+	.05	.05	.90

Fiber Feeder Pullbox Spacing, feet

DEFINITION

The distance, in feet, between pullboxes for underground fiber feeder cable.

DEFAULT VALUES

Fiber Feeder Pullbox Spacing, feet	
Density Zone	Distance between pullboxes, ft

0-5	2,000
5-100	2,000
loo-200	2,000
200650	2,000
650-850	2,000
850-2,550	2,000
2,550-5,000	2,000
5,000-10,000	2,000
10,000+	2,000

Buried Fiber Sheath Addition, per foot

DEFINITION

The cost of dual sheathing for additional mechanical protection of buried fiber feeder cable.

DEFAULT VALUE

$0.20/foot

Fiber Structure Pole Spacing, feet

DEFINITION

See Copper Structure Pole Spacing, above. Aerial structure is common to fiber and copper feeder.

Copper Feeder Maximum Distance, feet

DEFINITION

The feeder length **above** which fiber feeder cable is used in lieu of copper cable.

DEFAULT VALUE

9,000 ***ft.***

Structure Sharing

Sharing Parameters

Structure Percentage Assigned-to Telephone

DEFINITION

The fraction of investment in distribution and feeder poles and trenching that is assigned to **LECs**. The remainder is attributed to other utilities/carriers.

Default Values

	Structure Percent Assigned to Telephone Co.					
	Distribution			Feeder		
Density Zone	Aerial	Buried	Underground	Aerial	Buried	Underground
0-5	.50	.33	1.00	.50	.40	.50
5-100	.33	.33	.50	.33	.40	.50
100-200	.25	.33	.50	.25	.40	.40
200-650	.25	.33	.50	.25	.40	.33
650-850	.25	.33	.40	.25	.40	.33
850-2,550	.25	.33	.33	.25	.40	.33

2,550-5,000	.25	.33	.33	.25	.40	.33
5,000-10,000	.25	.33	.33	.25	.40	.33
10,000+	.25	.33	.33	.25	.40	.33

Fraction Poles and Buried/UG Placement Common With Feeder

DEFINITION

The percentage of structure supporting interoffice transport facilities that is also shared by feeder facilities, expressed as a fraction of the smaller of the investment in the three types of facilities (aerial, buried and underground are treated separately).

DEFAULT

.75

Fraction of interoffke structure assigned to telephone

DEFINITION

The fraction of investment in interoffice poles and trenching that is assigned to LECs. The remainder is attributed to other utilities/carriers

'DEFAULTVALUE

Fraction of Interoffice Structure Assigned to Telephone		
Aerial	Buried	Underground
.33	.33	.33

Outside Plant Material and Installation Costs

Drop and Distribution Parameters

Drop Parameters

Drop Distance

DEFINITION

The average length of a drop cable in each of nine density zones.

DEFAULTVALUES

Drop Distance by Density	
Density Zone	Drop Distance, feet
0-5	150
5-100	150
100-200	100
200-650	100
650-850	50
850-2,550	50
2,550-5,000	50
5,000-I 0,600	50
10,000+	50

Drop Placement, Aerial and Buried

DEFINITION

The total placement cost by density zone of an aerial drop wire, and the cost per foot for buried distribution cable placement, respectively.

DEFAULT VALUE

Drop Placement, Aerial & Buried		
Density Zone	Aerial, total	Buried, per foot
0-5	$58.33	$0.75
5100	$58.33	$0.75
loo-200	$46.67	$0.75
200-650	$35.00	$0.75
650-850	$23.33	$0.75
850-2,550	$11.67	$0.75
2,550-5,000	$11.67	$1.13
5,000-10,000	$11.67	$1.50
10,000+	$11.67	$5.00

Buried Drop Sharing Fraction

DEFtNtTtON

The fraction of buried drop cost that is assigned to the telephone company. The other portion of the cost is borne by other utilities.

DEFAULT VALUE

Buried Drop Sharing Fraction	
Density Zone	Fraction
0-5	1.00
5100	1.00
100-200	1.00
200650	1.00
650-850	1.00
850-2,550	1.00
2,550-5,000	1.00
5,000-10,000	1.00
10,000+	1.00

Drop Cable Investment, per foot and Pairs per Wire

DEFtNtTtON

The investment per foot required for aerial and buried drop wire, and the number of pairs in each type of drop wire.

DEFAULT VALUES

Drop Cable Investment		
Aerial	$0.095	2
Buried	$0.140	3

NID Investment per line

DEFINITION

The investment in the components of the network interface device (NID), the device at the customers' premises within which the drop wire terminates, and which is the point of subscriber demarcation.

DEFAULT VALUES

NID Materials and Installation	
Residential NID case, no protector	$10.00
Residential NID basic labor	$15.00
Installed NID case	$25.00
Maximum lines per res. NID	6
Protection block, per line	34.00
Business NID case, no protector	$25.00
Business NID basic labor	$15.00
Installed NID case	$40.00
Protection block, per line	$4.00

Terminal and Splice Investment per line

DEFINITION

The installed cost per line for the terminal and splice that connect the drop to the distribution cable.

DEFAULT VALUE

Terminal and Splice Investment per	
Buried	Aerial
$42.50	$32.00

Distribution Parameters

Distribution Cable Sizes

DEFINITION

The default cable sizes used for distribution cable **variables.**

DEFAULT VALUES

Cable Sizes
2400
1800
1200
900
600
400
200
100
50
25

Copper Distribution Cable, $/foot

DEFINITION

The cost per foot of copper distribution cable, as a function of cable size, including the costs of engineering, installation, and delivery, as well as the cable material itself.

DEFAULT VALUES

Copper Distribution Cable, $/foot	
Cable Size	Cost/foot (including engineering, installation, delivery and material)
2400	$42.75
1800	$32.25
1200	$21.75
900	$16.50
600	$11.25
400	$7.75
200	34.25
100	$2.50
50	$1.63
25	$1.19

Riser Cable, $/foot

DEFINITION

The cost per foot of copper riser cable (cable inside high-rise buildings), as a function of cable size, including the costs of engineering, installation, and delivery, as well as the cable material itself.

DEFAULT VALUES

Fiber Cable, [illegible]	
Cable Size	[illegible]
2400	$42.75
1800	$32.25
1200	$21.75
900	$16.50
600	$11.25
400	$7.75
200	$4.25
100	$2.50
50	$1.63
25	$1.19

Distribution Buried Installation Cost/Foot

DEFINITION

The cost per foot of placing distribution cable in trenches.

DEFAULT VALUES

Distribution Buried Installation Cost/Foot	
Density Zone	Default
0-5	$1.77
5-100	$1.77
100-200	$1.77
200-650	$1.93
650-850	$2.17
850-2,550	$3.54
2,550-5,000	$4.27
5,000-10,000	$13.00
10,000+	$45.06

Distribution Structure Conduit Placement Cost/Foot

DEFINITION

The cost per foot of placing underground conduit and copper distribution cable.

DEFAULT VALUES

[illegible]	[illegible]
0-5	$10.29
5100	$10.29
100200	$10.28
200-650	$11.35
650-850	$11.68
850-2,550	$16.40
2,5565,000	$21.60
5,000-10,000	$50.10
10,000+	$75.00

Serving Area Interface (SAI) Investment

DEFINITION

The investment in the installed SAI that acts as the physical interface point between distribution and feeder cable.

DEFAULT VALUES

[illegible]		
Cable Size	Indoor SAI	Outdoor SAI
2400	$1,052	$4,469
1800	$864	$3,569
1200	$576	$2,610
900	3432	$2,028
600	$288	$1,500
400	$192	$1,071
200	$96	$902
100	$48	$642
50	$48	$300
25	$48	$250

Geographic Parameter

Sparse CBG Threshold

DEFINITION

The percentage of empty space in a CBG, above which the model applies the number of clusters variable.

DEFAULT

0.50

Number of Clusters

DEFINITION

The number of distribution clusters assumed in a sparsely populated CBG.

DEFAULT

2

Distribution Multiplier, Difficult Terrain

DEFINITION

The amount of extra distance required to route distribution and feeder cable around difficult soil conditions, expressed as a multiplier of the distance calculated for normal situations.

DEFAULT

1.2

Rock Depth Threshold, feet

DEFINITION

The depth of bedrock, above which (that is, closer to the surface) additional costs are incurred for placing distribution or feeder cable.

DEFAULT

2 feet

Hard Rock Placement Multiplier

DEFINITION

The increased cost required to place distribution or feeder cable in bedrock classified as hard, when it is within the rock depth threshold of the surface, expressed as a multiplier of normal installation cost per foot.

DEFAULT

3.5

Soft Rock Placement Multiplier

DEFINITION

The increased cost required to place distribution or feeder cable in bedrock classified as soft, when it is within the rock depth threshold of the surface, expressed as a multiplier of normal installation cost per foot.

DEFAULT

2.0

Town Factor

DEFINITION

The fraction of business and residential customers that are assumed to be located in towns, as opposed to surrounding areas, for those cases in which the model determines that population should be clustered in towns.

DEFAULT

.85

Maximum Lot Size, in acres

DEFINITION

The maximum effective lot size in a CBG, above which it is assumed that the population is clustered into areas whose effective lot size is the default value (that is, there is a cap on the amount of land each subscriber occupies).

DEFAULT

3.0 acres

Town Lot Size, in acres

DEFINITION

The maximum lot size of subscribers residing in towns when the model determines that clustering in towns is appropriate.

DEFAULT

3.0 acres

Copper Cable Parameters

Copper Feeder Cable, $/ foot

DEFINITION

The cost per foot of copper feeder cable, as a function of cable size, including the costs of engineering, installation, and delivery, as well as the cable material itself.

DEFAULT VALUE

Copper Feeder Investment, per foot	
Cable Size	$/foot (ug/a & aerial)
4200	$74.25
3600	$63.75
3000	$53.25
2400	642.75
1800	$32.25
1200	$21.75
900	$16.50
800	$11.25
400	$7.75
200	$4.25
100	$2.50

Copper Feeder Buried Installation Cost/Foot

DEFINITION

The cost per foot of placing buried copper feeder cable.

DEFAULT VALUES

Copper Feeder Buried Installation Cost/Foot	
Density Zone	Cost/ft.
0-5	$1.77
5-100	$1.77
100-200	$1.77
200650	$1.93
650-850	$2.17