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December 15, 1997

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

Ms. Magalie Roman Salas  
Secretary  
Federal Communications Commission  
1919 M. St., NW, Room 222  
Washington, D.C. 20554

EX PARTE OR LATE FILED

RE: Ex Parte Presentation - Proxy Cost Models  
CC Docket No. 96-45

Dear Ms. Salas:

As indicated when AT&T and MCI filed Version 5.0 of the Hatfield Model ("HM 5.0") in CC Docket Nos. 96-45 and 97-160 on December 11, 1997, enclosed are extracts from the density zone expense modules for all non-rural carriers in all 50 states (ATU only, in AK), DC and Puerto Rico. The runs for these states were executed at a maximum analog copper loop length of 18,000 feet.

In addition to the model and its runs, this filing includes several sheets summarizing the aforementioned output runs, as well as two additional pieces of documentation. The first of these is the "Automation Description and User Guide" to the model. The second is a listing of all of the equations contained in the batch-executed modules (Distribution, Feeder and Switching and Interoffice) of the Hatfield Model. Because all equations in the expense modules are evaluated simultaneously and saved, an equation listing from the expense modules is not necessary.

Also included with this filing is a listing of the 584 clusters in the model's database that were inadvertently entered with incorrect line counts or cluster types (e.g., main versus outlier). The database entries for these clusters will be corrected shortly.

Note, that the results transmitted here show possibly excessive costs for interoffice transport for certain of the non-rural carriers. This largely occurs when the carrier's study area is composed of two or more non-contiguous regions within a state. The HM 5.0 displays high transport costs for these carriers because of its adherence to the FCC's Public Notice specification to provide ring-redundant interoffice transport for all wire centers. As these elevated costs indicate, there are likely more economical alternatives

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Ms. Magalie Roman Salas  
December 15, 1997  
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to carrier-specific rings to ensure reliable interoffice transport for carriers that have wire centers that are separated by other carriers' territories. The Hatfield Model sponsors expect to work with the Commission staff to determine a more appropriate specification.

Two copies of this Notice are being submitted to the Secretary of the FCC in accordance with Section 1.1206(a)(1) of the Commission's rules. Because of the need to transport physically a CD-ROM from New Jersey to Washington, DC, filing of the electronic media comprising the 52-jurisdiction Hatfield Model, its documentation and these runs, is deferred until December 16, 1997.

Sincerely,



Richard N. Clarke

Attachments:    **Output Run Summaries**  
                  **Automation Description and User Guide**  
                  **Equation Listings**  
                  **List of Problem Clusters**  
                  **Output Runs for 113 Non-Rural Carriers in 52 Jurisdictions**

cc: Universal Service Branch

		Basic Local Service									
		Avg monthly cost per line									
State	Company	0-5 lines/sq mi	5-100 lines/sq mi	100-200 lines/sq mi	200-650 lines/sq mi	650-850 lines/sq mi	850-2,550 lines/sq mi	2,550-5,000 lines/sq mi	5,000-10,000 lines/sq mi	>10,000 lines/sq mi	Weighted Average
Alaska	Anchorage Tel Util	\$115.49	\$37.02	\$26.47	\$20.64	\$19.48	\$17.42	\$15.79	\$15.56	\$12.42	\$16.88
Alaska	Anchorage Tel Util	\$115.49	\$37.02	\$26.47	\$20.64	\$19.48	\$17.42	\$15.79	\$15.56	\$12.42	\$16.88
Alabama	Contel Of The South Dbc Gte South	\$106.54	\$51.20	\$26.95	\$24.73	\$21.22	\$21.36	\$0.00	\$0.00	\$0.00	\$44.72
Alabama	Gte And Contel Of Alabama	\$104.17	\$50.79	\$25.53	\$20.39	\$16.88	\$15.98	\$13.84	\$10.72	\$0.00	\$34.29
Alabama	South Central Bell-Al	\$127.44	\$46.07	\$25.21	\$19.96	\$17.05	\$15.14	\$13.05	\$11.39	\$9.41	\$23.88
Arkansas	Gte And Contel Of Arkansas	\$108.83	\$48.42	\$29.43	\$24.99	\$22.68	\$19.23	\$14.97	\$0.00	\$0.00	\$45.02
Arkansas	Southwestern Bell-Arkansas	\$106.86	\$41.64	\$22.22	\$19.28	\$16.40	\$14.23	\$12.30	\$10.83	\$8.18	\$22.79
Arizona	Mountain Bell-Arizona	\$110.74	\$37.60	\$22.68	\$19.96	\$16.63	\$14.97	\$13.49	\$12.70	\$10.45	\$16.94
California	Contel Of California - California	\$114.50	\$41.37	\$29.61	\$24.85	\$20.99	\$20.20	\$17.03	\$15.74	\$0.00	\$32.02
California	Gte Of California	\$108.05	\$30.44	\$19.11	\$16.64	\$14.56	\$13.36	\$11.93	\$11.10	\$9.43	\$12.98
California	Pacific Bell	\$105.88	\$37.96	\$23.90	\$18.34	\$16.03	\$14.70	\$13.22	\$12.00	\$9.73	\$13.75
California	Roseville Telephone Company	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$18.86	\$17.19	\$17.34	\$0.00	\$17.28
Colorado	Mountain Bell-Colorado	\$136.50	\$42.69	\$28.79	\$20.78	\$19.11	\$16.21	\$14.65	\$12.95	\$9.67	\$19.11
Connecticut	Southern New England Tel	\$0.00	\$41.16	\$29.00	\$22.72	\$18.24	\$16.01	\$13.45	\$12.76	\$9.62	\$18.29
District of Columbia	C And P Telephone Company Of Wa Dc	\$0.00	\$14.15	\$0.00	\$18.23	\$20.52	\$16.50	\$14.74	\$14.64	\$9.32	\$10.64
Delaware	Diamond State Tel Co	\$71.49	\$34.24	\$23.72	\$17.80	\$14.95	\$14.16	\$13.21	\$12.38	\$8.29	\$16.89
Florida	Central Tel Co Of Florida	\$122.47	\$48.82	\$23.50	\$19.17	\$19.04	\$15.71	\$13.39	\$11.55	\$9.48	\$22.68
Florida	Gte Florida Inc	\$112.81	\$30.20	\$20.01	\$18.07	\$15.37	\$14.18	\$12.79	\$11.53	\$8.50	\$15.08
Florida	Southern Bell-Fl	\$81.32	\$34.89	\$22.37	\$18.82	\$16.91	\$14.58	\$12.91	\$11.83	\$9.28	\$15.40
Florida	United Tel Co Of Florida	\$103.18	\$34.20	\$23.13	\$18.88	\$15.79	\$14.22	\$11.79	\$11.42	\$8.34	\$18.72
Georgia	Attel Georgia Communications Corp	\$108.30	\$47.84	\$27.89	\$24.11	\$22.01	\$19.18	\$14.38	\$0.00	\$0.00	\$34.05
Georgia	Southern Bell-Ga	\$122.35	\$41.78	\$24.53	\$19.64	\$16.91	\$14.79	\$12.67	\$11.54	\$8.80	\$18.87
Hawaii	Gte Hawaiian Telephone Co Inc	\$84.39	\$33.78	\$24.81	\$20.52	\$23.60	\$18.78	\$15.76	\$14.75	\$12.12	\$19.27
Iowa	Gte And Contel Of Iowa	\$109.86	\$53.03	\$32.53	\$25.78	\$22.02	\$22.42	\$19.23	\$0.00	\$0.00	\$47.51
Iowa	Northwestern Bell-Ia	\$115.91	\$44.59	\$21.96	\$18.05	\$16.02	\$14.17	\$12.39	\$10.80	\$7.91	\$18.82
Idaho	Gte Northwest Inc - Idaho	\$113.48	\$43.40	\$25.06	\$19.34	\$16.64	\$14.54	\$12.41	\$11.03	\$8.92	\$30.41
Idaho	Mountain Bell-Idaho	\$102.23	\$41.31	\$24.27	\$18.73	\$15.20	\$15.86	\$12.22	\$11.17	\$8.44	\$21.85
Illinois	Central Tel Co Of Il	\$149.77	\$58.10	\$28.24	\$23.61	\$15.23	\$14.99	\$14.50	\$12.82	\$12.03	\$17.75
Illinois	Contel Of Illinois Inc Dba Gte - Illinois	\$112.68	\$63.80	\$40.92	\$34.66	\$38.02	\$29.17	\$25.28	\$24.52	\$23.47	\$48.98
Illinois	Gte Of Illinois	\$103.67	\$45.47	\$24.62	\$19.62	\$20.08	\$16.39	\$13.24	\$11.37	\$12.03	\$28.75
Illinois	Illinois Bell Tel Co	\$145.01	\$45.05	\$25.33	\$20.67	\$17.89	\$15.62	\$13.86	\$12.92	\$10.03	\$14.73
Indiana	Contel Of Indiana Inc Dba Gte - Indiana	\$92.93	\$50.07	\$29.28	\$21.80	\$16.32	\$18.52	\$15.89	\$11.03	\$0.00	\$34.28
Indiana	Gte Of Indiana	\$99.84	\$44.51	\$24.36	\$19.97	\$16.42	\$15.23	\$12.38	\$12.30	\$8.50	\$21.20
Indiana	Indiana Bell Tel Co	\$48.30	\$42.79	\$24.21	\$18.97	\$16.33	\$14.04	\$12.47	\$11.11	\$9.41	\$16.52
Indiana	United Tel Co Of Indiana Inc	\$130.12	\$51.40	\$26.07	\$23.67	\$17.57	\$17.98	\$16.01	\$12.69	\$0.00	\$33.01
Kansas	Southwestern Bell-Kansas	\$254.64	\$61.87	\$29.02	\$24.62	\$21.39	\$17.72	\$15.57	\$14.03	\$12.17	\$22.28
Kansas	United Telephone Co Of Ks	\$198.12	\$65.56	\$33.70	\$29.57	\$26.88	\$27.33	\$26.96	\$18.78	\$0.00	\$52.63
Kentucky	Cincinnati Bell-Ky	\$0.00	\$51.12	\$32.19	\$26.35	\$20.96	\$20.14	\$17.74	\$17.65	\$14.85	\$25.40
Kentucky	Gte South Inc - Kentucky	\$105.04	\$43.21	\$21.86	\$18.34	\$15.94	\$14.43	\$12.74	\$12.29	\$9.09	\$23.05
Kentucky	South Central Bell-Ky	\$98.61	\$44.80	\$24.12	\$20.44	\$17.16	\$15.18	\$13.19	\$11.94	\$10.48	\$23.97
Louisiana	South Central Bell-La	\$104.86	\$43.36	\$25.74	\$19.78	\$16.87	\$14.73	\$12.80	\$11.83	\$9.53	\$20.66
Massachusetts	New England Tel-Ma	\$76.64	\$37.74	\$26.12	\$20.62	\$17.40	\$14.97	\$12.77	\$11.86	\$9.43	\$15.52
Maryland	C And P Tel Co Of Md	\$83.42	\$40.57	\$27.38	\$20.92	\$17.39	\$14.81	\$12.95	\$12.38	\$9.17	\$16.65
Maine	New England Tel-Maine	\$135.62	\$41.68	\$24.38	\$18.98	\$16.13	\$14.43	\$11.99	\$10.29	\$8.71	\$24.91
Michigan	Gte North Inc-Mi	\$94.66	\$39.43	\$25.04	\$19.96	\$17.38	\$14.89	\$12.44	\$13.80	\$10.01	\$27.76
Michigan	Michigan Bell Tel Co	\$110.50	\$40.17	\$23.47	\$18.81	\$15.80	\$13.86	\$12.59	\$11.89	\$9.43	\$16.37
Minnesota	Contel Of Minnesota Inc Dba Gte Minnesota	\$132.87	\$60.73	\$36.50	\$34.72	\$33.88	\$30.13	\$31.26	\$22.85	\$0.00	\$80.14
Minnesota	Frontier Comm Of Minnesota Inc	\$130.16	\$58.65	\$33.62	\$28.51	\$26.11	\$21.71	\$21.73	\$21.05	\$16.73	\$35.55
Minnesota	Northwestern Bell-Minnesota	\$144.31	\$49.35	\$23.87	\$19.10	\$16.37	\$14.80	\$13.01	\$11.84	\$9.33	\$18.38
Minnesota	United Telephone Co Of Minn	\$114.37	\$52.67	\$27.48	\$24.63	\$18.85	\$17.45	\$18.14	\$16.96	\$0.00	\$31.57
Missouri	Gte And Contel Of Missouri	\$118.58	\$51.52	\$26.29	\$22.67	\$18.23	\$18.89	\$16.08	\$15.76	\$0.00	\$43.12
Missouri	Southwestern Bell-Missouri	\$133.66	\$51.78	\$23.24	\$20.33	\$17.50	\$15.28	\$13.32	\$12.79	\$10.03	\$18.75
Missouri	United Telephone Co Of Missouri	\$138.11	\$59.15	\$28.85	\$22.52	\$20.46	\$18.42	\$17.79	\$12.28	\$12.39	\$34.62
Mississippi	South Central Bell-Mississippi	\$117.18	\$54.11	\$25.99	\$20.62	\$18.48	\$15.93	\$13.44	\$11.67	\$8.12	\$31.09
Montana	Mountain Bell-Montana	\$161.52	\$37.79	\$20.28	\$20.50	\$18.46	\$15.14	\$13.17	\$11.00	\$8.80	\$25.29
North Carolina	Attel Carolina Inc-North	\$105.81	\$43.90	\$30.08	\$24.80	\$19.92	\$17.04	\$15.96	\$0.00	\$0.00	\$28.97

		Basic Local Service									
		Avg monthly cost per line									
State	Company	0-5 lines/sq mi	5-100 lines/sq mi	100-200 lines/sq mi	200-650 lines/sq mi	650-850 lines/sq mi	850-2,550 lines/sq mi	2,550-5,000 lines/sq mi	5,000-10,000 lines/sq mi	>10,000 lines/sq mi	Weighted Average
North Carolina	Carolina Tel And Tel Co	\$102.97	\$52.16	\$27.69	\$22.27	\$19.93	\$16.76	\$14.33	\$12.25	\$0.00	\$31.83
North Carolina	Central Tel Co-Nc	\$106.24	\$46.31	\$30.16	\$21.73	\$21.07	\$16.87	\$11.56	\$0.00	\$0.00	\$26.66
North Carolina	Contel Of North Carolina Db	\$96.14	\$41.08	\$25.17	\$19.43	\$14.81	\$13.29	\$11.54	\$0.00	\$0.00	\$34.19
North Carolina	Gte South Inc - North Carolina	\$0.00	\$36.99	\$23.79	\$19.17	\$16.58	\$14.13	\$12.15	\$12.31	\$8.08	\$17.37
North Carolina	North State Tel Co-Nc	\$0.00	\$35.69	\$29.64	\$21.25	\$18.35	\$16.61	\$13.81	\$11.72	\$0.00	\$20.78
North Carolina	Southern Bell-Nc	\$98.56	\$39.53	\$26.05	\$19.91	\$15.71	\$14.77	\$12.24	\$11.23	\$7.88	\$19.04
North Dakota	Northwestern Bell-North Dakota	\$174.76	\$45.15	\$23.33	\$22.04	\$19.40	\$14.66	\$13.26	\$12.34	\$10.22	\$24.26
Nebraska	Lincoln Tel And Tele Co	\$130.11	\$47.95	\$20.41	\$23.42	\$29.28	\$19.58	\$17.14	\$16.76	\$13.39	\$30.52
Nebraska	Northwestern Bell-Nebraska	\$286.64	\$51.78	\$27.13	\$21.43	\$22.03	\$16.92	\$16.04	\$13.99	\$11.81	\$24.77
New Hampshire	New England Tel-Nh	\$125.88	\$41.81	\$24.05	\$19.38	\$16.42	\$14.25	\$11.94	\$10.42	\$9.08	\$21.16
New Jersey	New Jersey Bell	\$133.53	\$34.11	\$24.50	\$19.51	\$16.21	\$14.41	\$12.74	\$11.90	\$9.82	\$13.77
New Jersey	United Tel Co Of Nj Inc	\$229.34	\$34.00	\$27.22	\$20.11	\$18.91	\$14.35	\$9.51	\$9.67	\$0.00	\$21.56
New Mexico	Mountain Bell-New Mexico	\$151.49	\$38.79	\$25.31	\$21.35	\$17.34	\$15.47	\$12.94	\$12.42	\$9.45	\$21.77
Nevada	Central Telephone Company - Nevada	\$98.18	\$24.16	\$19.03	\$16.94	\$16.16	\$14.57	\$12.89	\$12.70	\$10.53	\$14.15
Nevada	Nevada Bell	\$233.77	\$38.98	\$26.52	\$20.60	\$18.17	\$18.37	\$15.84	\$13.95	\$11.59	\$23.85
New York	Citizens Telecom-Ny	\$129.64	\$44.88	\$29.07	\$25.05	\$21.93	\$19.07	\$15.77	\$14.39	\$0.00	\$35.16
New York	New York Tel	\$144.09	\$46.67	\$26.90	\$21.83	\$19.55	\$16.51	\$14.82	\$14.02	\$9.65	\$14.79
New York	Rochester Telephone Corp	\$0.00	\$42.35	\$28.24	\$21.94	\$18.24	\$17.74	\$15.63	\$14.92	\$12.67	\$19.58
Ohio	Alltel Ohio Inc	\$0.00	\$46.93	\$29.53	\$26.68	\$21.19	\$19.23	\$17.02	\$14.54	\$13.73	\$24.80
Ohio	Gte North Inc-Oh	\$78.25	\$41.81	\$25.48	\$19.73	\$17.86	\$15.30	\$12.85	\$11.11	\$0.00	\$26.92
Ohio	Ohio Bell Tel Co	\$104.22	\$40.50	\$25.45	\$19.21	\$16.19	\$14.38	\$12.67	\$11.91	\$8.67	\$15.34
Ohio	United Tel Co Of Ohio	\$110.82	\$46.18	\$28.42	\$21.21	\$19.31	\$17.10	\$13.27	\$11.25	\$9.63	\$27.88
Oklahoma	Gte Southwest Inc - Oklahoma	\$112.74	\$47.06	\$22.02	\$21.05	\$14.47	\$15.69	\$12.96	\$12.68	\$0.00	\$27.45
Oklahoma	Southwestern Bell-Oklahoma	\$133.04	\$46.13	\$23.84	\$21.17	\$17.57	\$15.42	\$13.42	\$12.16	\$9.78	\$22.57
Oregon	Gte Of The Northwest	\$130.39	\$38.19	\$24.43	\$18.89	\$15.80	\$13.46	\$12.30	\$10.39	\$9.01	\$18.91
Oregon	Pacific Northwest Bell-Oregon	\$130.68	\$45.51	\$28.86	\$21.42	\$17.22	\$15.61	\$13.39	\$12.20	\$8.53	\$19.05
Pennsylvania	Alltel Pennsylvania Inc	\$132.17	\$49.27	\$30.54	\$26.23	\$23.05	\$20.25	\$18.17	\$13.81	\$13.13	\$33.52
Pennsylvania	Bell Of Pennsylvania	\$129.76	\$45.70	\$28.78	\$21.51	\$17.51	\$15.76	\$13.11	\$11.99	\$9.71	\$16.41
Pennsylvania	C-Tec Corp	\$96.31	\$44.18	\$28.65	\$26.13	\$22.25	\$21.63	\$16.70	\$19.80	\$0.00	\$33.49
Pennsylvania	Gte North Inc-Pa And Contel	\$87.81	\$37.35	\$25.47	\$20.40	\$16.39	\$15.35	\$13.47	\$12.03	\$8.99	\$20.37
Pennsylvania	United Tel Co Of Pa	\$80.03	\$43.08	\$28.55	\$23.06	\$18.94	\$17.45	\$15.09	\$12.55	\$10.96	\$26.59
Puerto Rico	P R T C - Central	\$23.63	\$15.69	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$22.26
Puerto Rico	Puerto Rico Tel Co	\$23.72	\$16.77	\$13.07	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$21.69
Rhode Island	New England Tel-Ri	\$0.00	\$33.89	\$23.27	\$19.42	\$15.20	\$14.54	\$12.92	\$11.76	\$9.52	\$15.33
South Carolina	Gte South Inc - South Carolina	\$93.05	\$45.67	\$23.13	\$19.12	\$16.55	\$14.80	\$11.49	\$14.47	\$0.00	\$23.24
South Carolina	Southern Bell-Sc	\$103.85	\$39.49	\$24.32	\$19.56	\$15.94	\$14.53	\$12.95	\$11.26	\$8.71	\$20.81
South Dakota	Northwestern Bell-South Dakota	\$178.43	\$34.77	\$21.93	\$17.18	\$15.15	\$14.92	\$13.90	\$12.08	\$9.54	\$24.92
Tennessee	South Central Bell-Tn	\$122.30	\$45.66	\$26.54	\$19.47	\$16.98	\$15.10	\$13.32	\$12.18	\$9.14	\$21.34
Tennessee	United Inter-Mountain Tel Co-Tn	\$0.00	\$40.38	\$25.78	\$20.93	\$16.03	\$14.39	\$12.50	\$9.98	\$9.05	\$22.88
Texas	Central Telephone Company Of Texas	\$138.38	\$44.17	\$23.68	\$20.88	\$15.32	\$15.65	\$13.97	\$11.93	\$12.95	\$23.74
Texas	Contel Of Texas Inc Db	\$110.14	\$51.39	\$38.19	\$23.31	\$30.54	\$16.96	\$15.22	\$13.86	\$0.00	\$50.70
Texas	Gte Southwest Inc - Texas	\$157.33	\$43.18	\$25.43	\$20.83	\$17.13	\$15.67	\$14.14	\$13.27	\$12.67	\$22.47
Texas	Southwestern Bell-Texas	\$135.99	\$42.03	\$23.96	\$20.25	\$16.75	\$14.62	\$12.96	\$12.08	\$9.94	\$16.98
Texas	United Telephone Co Of Texas Inc	\$140.39	\$55.07	\$28.17	\$21.99	\$20.31	\$17.00	\$14.32	\$0.00	\$0.00	\$41.05
Utah	Mountain Bell-Utah	\$97.36	\$37.43	\$26.71	\$20.39	\$18.72	\$15.32	\$13.71	\$12.35	\$9.79	\$17.59
Virginia	C And P Tel Co Of Va	\$107.87	\$47.12	\$26.11	\$19.51	\$17.72	\$14.62	\$12.90	\$11.60	\$9.81	\$17.34
Virginia	Central Tel Co Of Va	\$107.47	\$54.52	\$27.41	\$23.87	\$20.63	\$16.67	\$13.77	\$12.90	\$10.41	\$34.14
Virginia	Contel Of Virginia Inc Db	\$101.25	\$43.25	\$24.53	\$19.27	\$16.91	\$14.45	\$13.56	\$11.96	\$0.00	\$25.17
Virginia	United Inter-Mountain Tel Co-Va	\$89.99	\$44.94	\$30.54	\$19.88	\$9.15	\$13.22	\$16.85	\$11.43	\$0.00	\$26.85
Vermont	New England Tel-Vt	\$120.53	\$44.76	\$22.95	\$22.06	\$15.56	\$14.29	\$11.95	\$12.12	\$9.05	\$26.17
Washington	Gte Northwest Inc - Washington	\$110.64	\$35.13	\$24.32	\$18.40	\$15.06	\$14.39	\$11.96	\$11.37	\$9.03	\$17.93
Washington	Pacific Northwest Bell-Washington	\$146.71	\$40.18	\$25.82	\$20.52	\$17.70	\$15.06	\$13.13	\$11.74	\$8.25	\$16.87
Washington	Telephone Utilities Of Wa Inc	\$143.83	\$48.73	\$34.74	\$31.36	\$30.71	\$25.74	\$23.18	\$0.00	\$0.00	\$49.10

# **Hatfield Model**

## **Release 5.0**

### *Automation Description and User Guide*

HAI Consulting, Inc.

737 29<sup>th</sup> Street, Suite 200  
Boulder, Colorado 80303

December 15, 1997

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## 1. General Description

The Hatfield Model Release 5.0 ("HM 5.0") calculates the cost of unbundled network elements (UNEs), Universal Service Funding (USF) requirements, and the cost of carrier access and interconnection through the use of a highly sophisticated costing tool.<sup>1</sup> The computer program chosen to support such a complicated analysis is Microsoft Excel 97. The Model's calculations are contained in four Excel workbooks; these workbooks constitute the following modules:

1. *Distribution Module*
2. *Feeder Module*
3. *Switching and Interoffice Module*
4. *Expense Module (Summarized by CBG, Density Zone, or Wirecenter).*

A USF summary module is also provided. This module allows the user to combine and summarize the USF results from a selection of companies with previously prepared expense modules.

The Hatfield Model's developers and sponsors believe that a model developed in a readily understandable and ubiquitous spreadsheet program will permit detailed analysis of the calculations, algorithms, and user definable inputs. Moreover, the use of Microsoft Excel's auditing tools will allow the user to determine relationships among the Model's various inputs and outputs.

While HM 5.0 remains a spreadsheet-based model, it uses two Microsoft programming languages – Visual Basic (VB) and Visual Basic for Applications (VBA) – and a database to integrate the HM 5.0's four calculating modules (See Model flowchart on the following page). The use of programming code and macros allows the model to run with limited user intervention. The programming code automates the copy and paste functions when applying intermediate results and data calculations among the Model's modules. Although the model will execute successfully on less capable machines, the recommended PC for repetitive uses of the model is a 200 MHz Pentium processor with 64Mb of RAM.

HM 5.0 takes advantage of Microsoft's object oriented structure to enhance the Model's speed and functionality. Structured Query Language (SQL) database queries have removed the need for complex and time consuming data aggregation functions within Excel, permitting the model to calculate quickly and produce results at various levels of aggregation.

Three of the model's VB/VBA calculations are performed within the database. First, the database aggregates Distribution Module results for outlier cluster and associates these results with the outlier's "home" main cluster. Second, the database aggregates investment results from the Cluster level to the Wire Center and Density Zone levels. And third, the database assigns switching and interoffice investments, developed on a per-line basis, to each cluster. In both cases the Model utilizes simple arithmetic calculations that can be externally verified by the user. Use of the database increases the efficiency of the Model, but does not compromise its audibility.

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<sup>1</sup> Please refer to the *Hatfield Model, Release 5.0 Model Description*, for a precise description of the Model's functions, including its evolution into the current release.

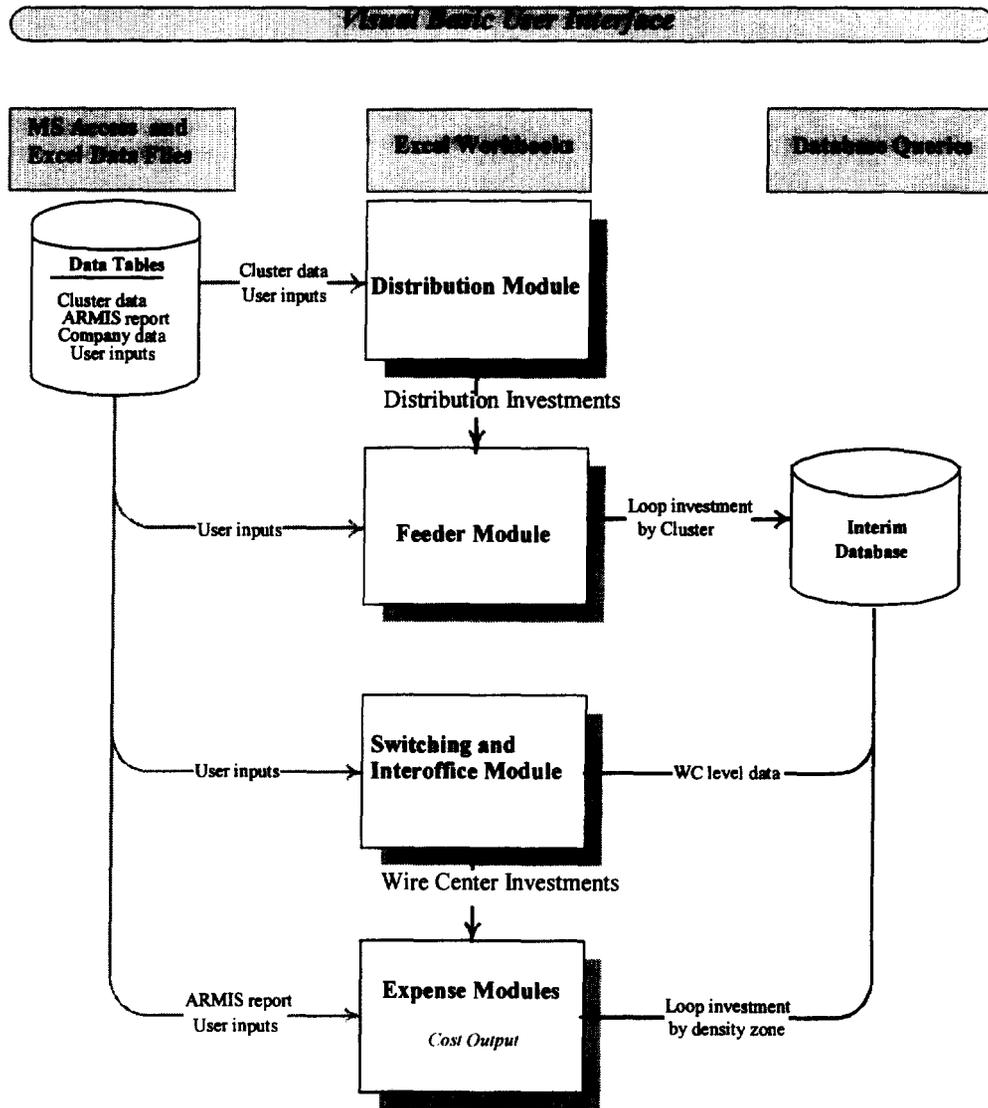
A final use of VBA is in the Switching and Interoffice Module for the determination of efficiently constructed interoffice transport rings.

To further enhance the Model's audibility, an Excel "workfile" is generated with each run to keep track of the intermediate results of each module. Using this workfile, the user can trace the development of investment results through each of the calculating modules.

## 2. HM 5.0 Module Flowchart

### HATFIELD MODEL, v5.0

#### Module Flowchart



### 3. System Requirements

In order to run HM 5.0, your PC should meet the following requirements:

- 133 MHz or faster Pentium processor (200 MHz preferred)\*
- 64 megabytes of RAM\*
- SVGA monitor set to 800 x 600 (or higher) display resolution
- 400 megabytes of available hard drive capacity
- Microsoft Windows NT or Windows 95 operating system
- Microsoft Office Professional 97, with Microsoft Service Release 1 (SR-1) installed

The items marked with an asterisk (\*) are recommendations, and should be followed if the Model is to be used for large companies in large states (e.g., California, New York, or Texas). For smaller companies, the Model will function on a smaller PC.

Please note that the preferred application software is Microsoft Office 97 Professional for Windows 95 that incorporates Excel 97, Access 97, and Word for Windows 97.<sup>2</sup> Use of this complete suite of Microsoft products will ensure that all file libraries that are needed to run the model will be installed. In addition, Word for Windows 97 permits users to examine the Model's documentation in electronic form, and Access 97 will permit the user to examine the Model's database more readily.

Users wishing to run the Model having only a stand-alone installation of Excel 97 should examine the "Readme.txt" file. This file is located in the Model's home directory or Section 8 of this documentation. The file explains instructions on how to ensure that the computer installation of supporting file libraries for Excel 97 is sufficient to run the model.

#### 4. Installation Instructions

HM 5.0 ships on the CD-ROM as a single self-extracting installation file. In order to install your copy of the HM 5.0 please follow these directions.

1. Ensure that your personal computer and its software meet the system requirements described in Section 3.
2. Place the HM 5.0 CD-ROM in your PC's CD-ROM drive.
3. Locate and double click on the *File Manager* or *Windows Explorer* icon.
4. Double click on the icon for your computer's CD-ROM drive.
5. Double click on the HM 5.0-installation icon. The model will first check to see if a previous installation of Release 5.0 of the Hatfield Model exists on your computer. If a previous

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<sup>2</sup> The HM 5.0 (for Office 97) requires the Microsoft Office 97 Service Release 1 (SR-1) update for proper operation. A copy of this service release and a program to check if it has already been installed on your PC is included with the HM 5.0 CD-ROM. Please view the "Overview\_Readme.doc" file in the CD-ROM's root directory for directions on how to install the SR-1 update for Microsoft Office 97. Previous versions of the HM (Releases 3.0, 3.1 and 4.0) were developed and tested to operate under Microsoft Excel 7.0, Access 7.0, and Word for Windows 7.0. The HM 5.0 will not operate under Microsoft Excel 7.0.

installation is found, you will be asked whether you wish this previous installation to be deleted, or the current installation process aborted. If you wish to retain your old installation of Release 5.0, you should choose to abort the installation process and use Windows File Manager or Explorer to change the name of the old installation's *HM50.exe* file to another name. You may then rerun the current installation process.<sup>3</sup>

6. The model will run a self-extraction routine that will install the Model and all of its components on your computer's internal hard drive.
7. You are now ready to run the HM 5.0.
8. Note, that as discussed in the "Overview\_Readme.doc" file on the CD-ROM, it is likely that your initial run of the HM 5.0 will terminate abnormally with an error message, "OLE Automation Error, Server threw an exception." This is a common occurrence. You should exit completely from the model, and shut all open copies of Excel. If you then re-execute the HM 5.0, your subsequent runs should be successful. Microsoft has been notified of the this systems "bug," but has not yet been able to provide a solution.<sup>4</sup>

## 5. Running the Model

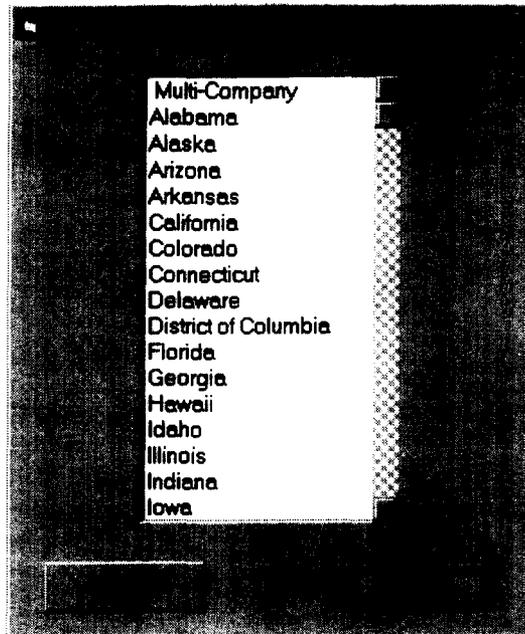
### *Select State*

Running HM 5.0 is straightforward. To start the program, click on its icon under the *Programs* entry on the *Start* menu (in Windows 95 or Windows NT 4.0), or the Hatfield Model program group (in Windows NT 3.51). A copyright message will appear, followed by the State Selection form. From this list, select the state you desire to run, or select the Multi-Company option. The Multi-Company option is explained in the sub-section, *Multi-Company Selection*:

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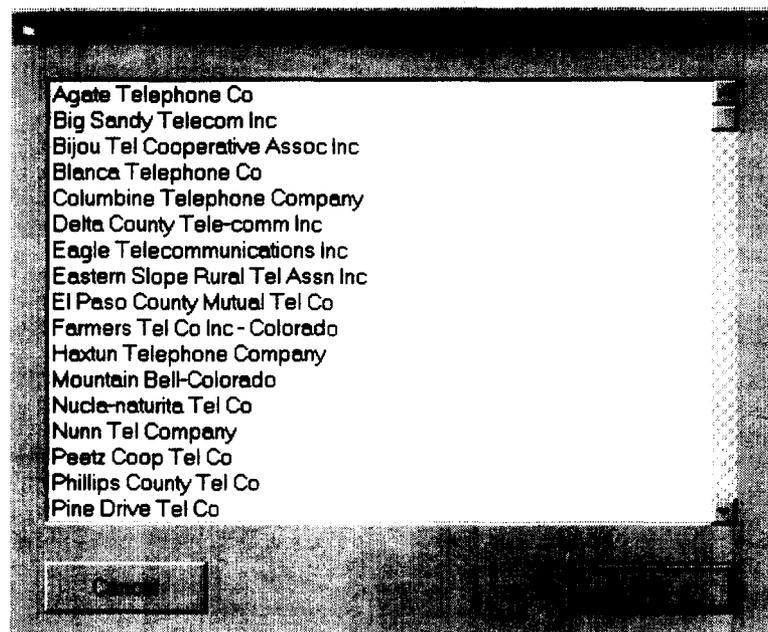
<sup>3</sup> Note that if you decide to preserve your previous installation of the HM 5.0, only the most recent installation will be "active" and be executed when you click on the Model's icon or entry in the Start menu.

<sup>4</sup> Because it is likely that your initial run will terminate abnormally, it is suggested that to save time, your "break-in" run should be of a small company.



### *Select Company*

After the State is selected, the Company Selection window will appear. This window will contain the names of all companies in the selected state for which HM 5.0 contains data. Select the appropriate company from this list.



If you have not previously run this State/Company combination under this installation of the HM 5.0, you will be asked if you wish to create a default scenario. You should click on "OK."

### ***Multi-Company Selection***

The Multi-Company feature will provide the ability to "batch together" several companies and allows the Model to run serially the selected companies without user intervention. The results files are stored in the "Results" subdirectory of the "HM50" directory (the default path will be *c:\program files\hm50\results\* under Windows 95 or Windows NT 4.0 and *c:\hm50\results\* under Windows NT 3.51). The Multi-Company scenario applies the same user input values to each of the selected companies.

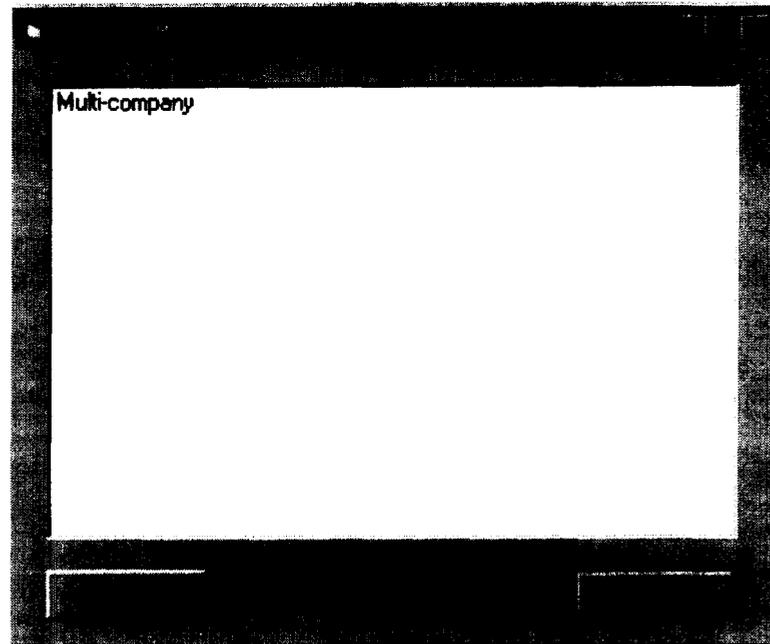
The Multi-Company option saves time in several ways:

- 1) The user does not have to sit at the PC and manually run each company individually; and
- 2) If the user wishes to apply the same "non-Default" input value scenario to more than one company, s/he does not have to create the same "non-Default" scenario over and over again for each individual company. The scenario is created once, and is reused for each selected company's runs.

The user has the option, when selecting companies for a Multi-Company run, to save the workfiles resulting from each individual company's run (the default path will be *c:\program files\hm50\workfiles\* under Windows 95 or Windows NT 4.0 and *c:\hm50\workfiles\* under Windows NT 3.51). Because this may use a great deal of hard drive space, the default is for the workfiles not to be saved.

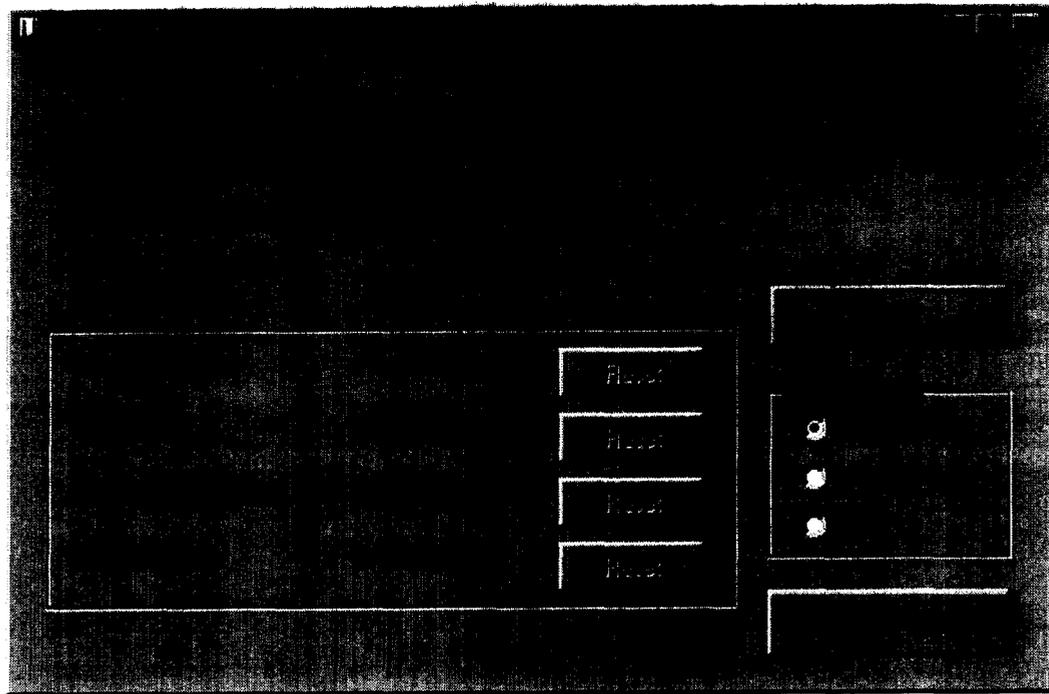
The Multi-Company selection is particularly useful for running all companies in a state, especially in conjunction with the newly added "summarize" function which totals USF results from any expense modules the user selects in a given directory. This effectively establishes a template that a user may be used to set state- or region-specific factors, which differ from national defaults.

In the company selection window, select the Multi-Company option:



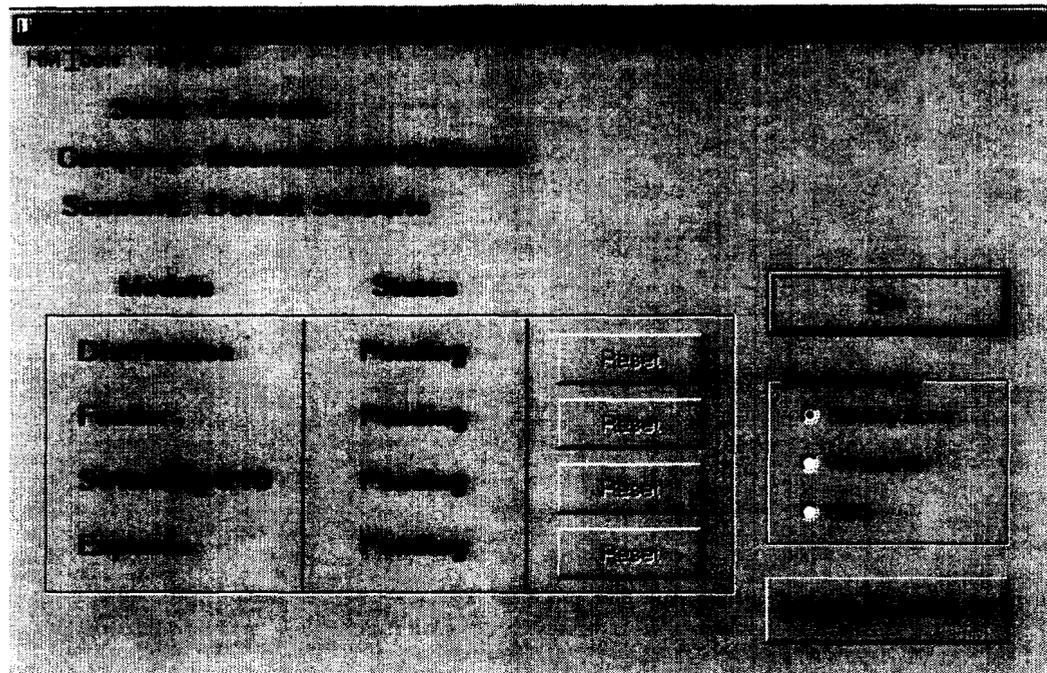
If you have not previously run the Multi-Company option under this installation of the HM 5.0, you will be asked if you wish to create a default scenario. You should click on "OK." As discussed in Sections 6 and 7, below, all options are available for creating, copying, and deleting run scenarios, and selecting alternate distribution, feeder, switching, and expense modules.

Companies to be included in the Multi-Company option are selected using the Multi-Company selection option under HM Tools. This form lists all of the companies for all of the states. A solid range of entries may be selected by clicking on the first company in the range, then pressing the Shift key and clicking on the last company in the range. A collection of individual companies can be selected for a Multi-Company by pressing the Ctrl key while clicking on the company's name. A second Ctrl-click on the entry will deselect it. This form also contains a check-box for indicating whether the workfiles from the Multi-Company run should be saved.



***Run the Model***

After the desired state and company are selected, the main window will appear.



To run the Model using default user inputs, select *Density Zone*, *Wirecenter*, or *CBG* level outputs, by clicking on the appropriate button. Click **Run**. The Model will automatically calculate its four modules, and produce results in the Expense Module. Finally, the model will prompt the user to save the now-populated Expense Module workbook.

As each of the modules is calculating, a status bar will display the progress of the calculations. As each module completes, the *Status* indicator will change from *Pending* to *Complete* to indicate that it has calculated successfully.

After a particular Company has been run once, subsequent runs will show the module Status as *Complete* for all modules. To re-run the model, click the **Reset** button next to the module from which you would like to restart the Model. For example, to re-run the Expense Module, click **Reset** next to the Expense Module status indicator, and click **Run**.

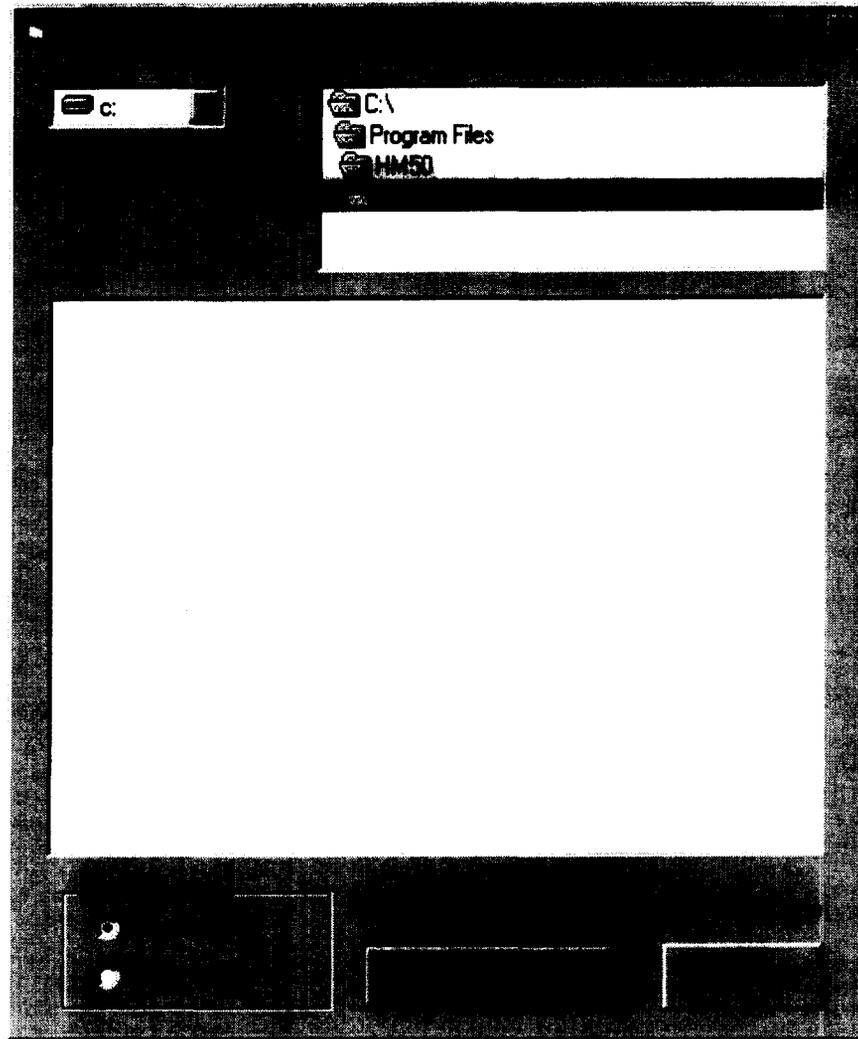
HM 5.0 results can be summarized by *Density Zone*, *Wirecenter*, or *CBG*. Click on the desired option on the main window before clicking **Run**. To see all outputs, first run the Model by *Density Zone* and save the results. Next, select either the *Wirecenter* or *CBG* outputs, click **Reset** next to the Expense module, and then click **Run**. The new output will be displayed.

To run the model with customized user inputs, see Section 6.

The length of computing time required to execute a run of the Hatfield Model depends both on the number of clusters and wire centers in the study area being run, and on the speed of the computer.

### ***Summarize Results Selection***

This selection, under the *HM Tools* select window, allows the user to summarize the USF results (dollars of support and lines only) for any *Density Zone* or *Wirecenter* expense modules the user targets in a given directory. When used with the *Multi-Company* selection, this function will give the user access to quick comparisons, based on the same user defined inputs. The select window is shown below:



The selected Results Files must match the Result File Type, either Density Zone or Wire Center file types.

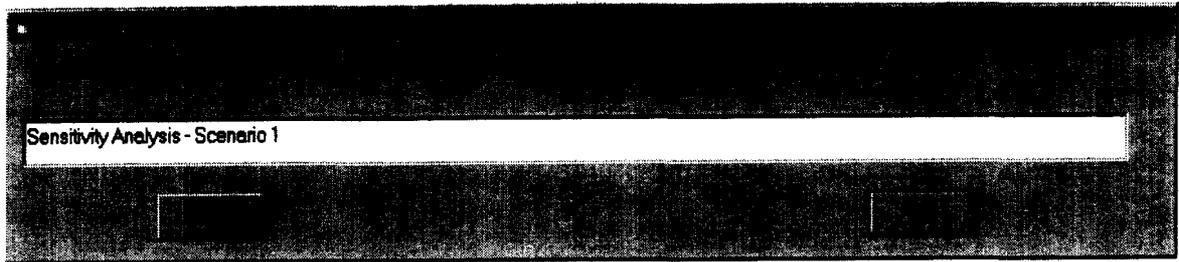
## 6. Adjusting User Inputs and Managing Scenarios

HM 5.0 has over 1400 user adjustable inputs. The Model has input boxes that allow these inputs to be changed easily, and provides a scenario manager that allows a user to keep track of various sets of input parameters.

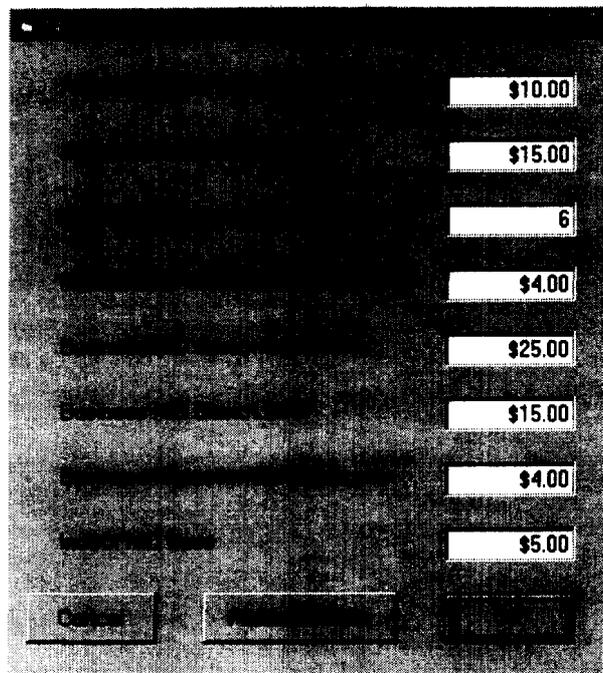
The *Default scenario* in HM 5.0 cannot be changed through the user interface, so a new scenario must be created before input values can be changed.<sup>5</sup> To create a new scenario, select *New HM Scenario* from the *HM Tools* menu. The following input box will appear, prompting for a scenario name. The scenario can have any name up to 100 characters in length.

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<sup>5</sup> Sophisticated users can alter the specification of the Default Scenario by editing the pertinent input tables in the Microsoft Access database table labeled "Scenario."



To change a user input, click on *HM Inputs*, then select the appropriate category and sub-category of inputs. An input box will appear:

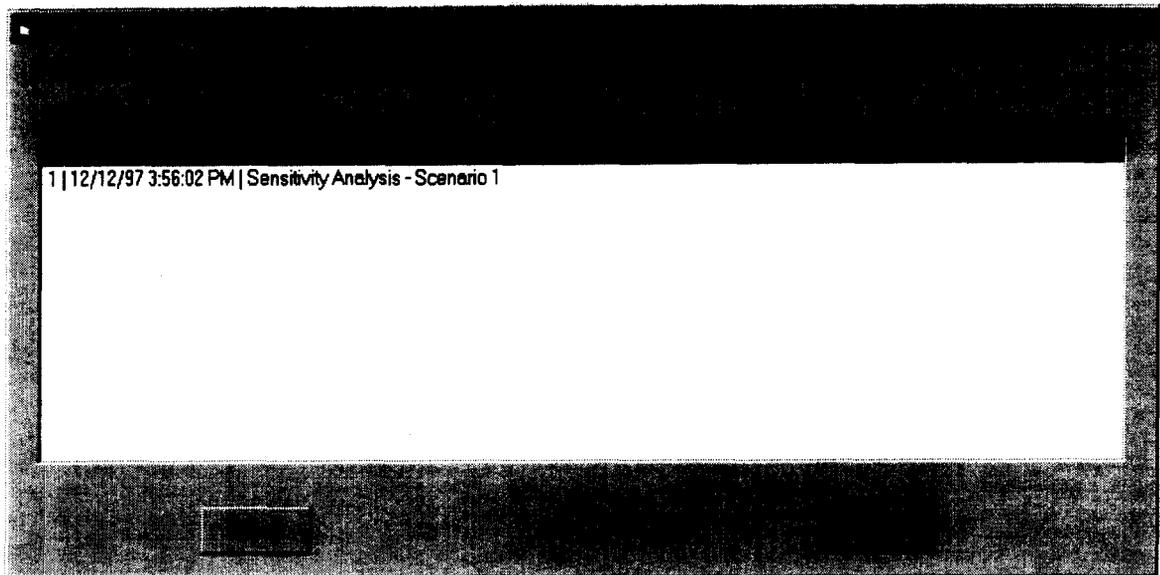


Inputs can be changed by simply typing new values in the spaces provided. Clicking *OK* will register the input change, clicking *Reset Defaults* will return each item to its original value, and clicking *Cancel* will close the input box without registering any changes.<sup>6</sup>

Once a scenario has been created, it can be modified incrementally. After the initial scenario is created, choose *Save HM Scenario As ...* from the *HM Tools* menu. An input box will appear, prompting for a new scenario name. Give the scenario a new name. The original scenario will be saved, and further changes can be made to the new scenario under its new name.

To return to a previously created scenario, choose *Open HM Scenario* from the *HM Tools* menu. The following selection box will appear, prompting the user to choose a scenario.

<sup>6</sup> The default scenario inputs are defined in Appendix B of the Model documentation. The HM 5.0 Inputs Portfolio also defines each default-input value and provides supporting documentation for each input.



Up to 9,999 different scenarios can be stored in the Model for each company. However, each scenario represents hundreds of input values, so the scenario database could become quite large. Scenarios can be deleted when they are no longer needed by selecting *Delete HM Scenario* from the *HM Tools* menu. A selection box will appear which allows scenarios to be deleted.

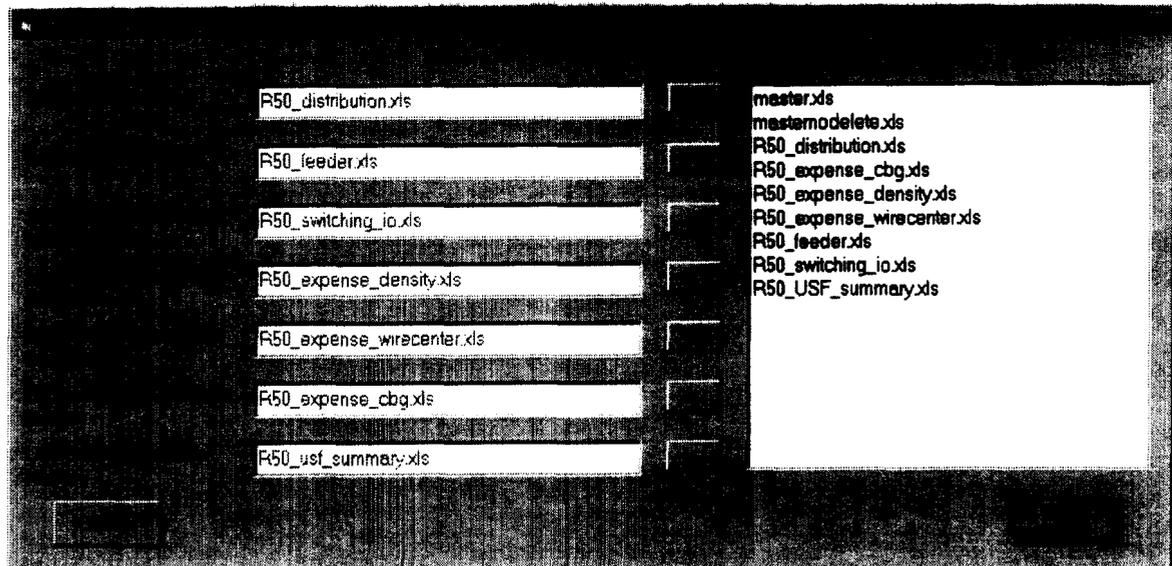
## 7. Additional Features

### *Changing Modules*

If it becomes necessary to replace or update the modules that constitute HM 5.0, the Model provides a mechanism to do so.

First, copy the new modules from the updated CD-ROM or diskette into the HM 5.0 Modules directory. (The default path will be *c:\program files\hm50\modules\* under Windows 95 or Windows NT 4.0 and *c:\hm50\modules\* under Windows NT 3.51.)

Next, select *Options* from the *HM Tools* menu. A selection box will appear which allows the working modules to be substituted. The right side of the selection box will show all the files that reside in the Modules directory. Select the new module from the list on the right, then click the appropriate button to send the module name to the appropriate box on the left. The module names listed on the left side of the form are the calculating modules used by the Model.



### ***Deleting Scenario Workfiles***

On certain system configurations, HM 5.0 can run up against the memory limitations of Microsoft Excel 97. This generally happens when running very large companies with completed workfiles (e.g., running Pacific Bell-CA or Southwestern Bell-TX subsequent to its initial run). If an *Out of Memory* error occurs when running a large company, click the ***Delete Scenario Workfile*** option on the ***HM Tools*** menu. This will delete the previously existing workfile (requiring the run to start from the *Distribution Module*), but should free up the required amount of memory.

## **8. Troubleshooting**

### ***Installation Problems***

All the information contained in this section may be found in the "Readme.txt" file located in the HM 5.0 home directory.

### **HM 5.0 Workstation Prerequisites**

The HM 5.0 is a Visual Basic application designed to run on a Windows 95, Windows NT 3.51, or Windows NT 4.0 workstation and interface with Microsoft Excel Version 97 with the Microsoft Office 97 Service Release 1 update. In addition to Excel, the "User Adjustable" inputs and other inputs to the application are maintained in a Microsoft Access 97 database that also resides on the workstation. It is not a requirement to have the MS Access software installed on the workstation, however, certain libraries must be in place for Excel to communicate with the Access database that is installed as part of the Model application.

**Excel must be set up to work with MS Access.**

This is an optional feature that may not have been selected when Excel was installed. If this feature of Excel was not installed, the HM 5.0 application will not function properly. The most common symptom is the Distribution Module will stall and the status message "Copying Scenario Inputs..." is displayed on the status bar. Another symptom may be a message something like "Runtime Error '424': Object Required" or another message that complains about "VBA Jet."

The most reliable way to verify that this option is installed is to rerun the Excel Setup Program and check the options listed on the Add/Remove Components form.

Another, slightly less reliable, solution is to verify the existence of a library file called "DAO350.DLL." This solution is less reliable because the Model Installation process places a copy of this file in the appropriate directory for use by the Visual Basic code. Therefore, depending on when you look for this file, (before or after the HM 5.0 Installation routine) it may be in the correct directory but still not "registered" with the Windows operating system. This file will most commonly be installed in the following platform specific directories:

**Win 95:** C:\Program Files\Common Files\Microsoft Shared\DAO  
**Win NT3.51:** C:\WINNT35\MSAPPS\DAO  
**Win NT4.0:** C:\WINNT\MSAPPS\DAO

To properly install and register this feature the Excel Setup Program must be rerun. When you get to the point where you can Add/Remove Components, Click on the Add/Remove Components button. On the next form select the Converter, Filters, Data Access option. On the next form select the Data Access option. Continue from this point by clicking the appropriate "OK", "Continue", or "Next" buttons to install this option. Once the Data Access option has been installed the errors/symptoms listed above should be resolved.

Workbook: **R50\_distribution.xls**  
 Worksheet: **cluster input data**

## Equation Listing

**Hatfield Model, v5.0**  
**Distribution Module**

Column	Name	Formula	Description
A	wire center	The data for this sheet is taken from the ClusterData table in the access database.	
B	company		
C	operating company type		
D	CBG geocode		
E	cluster		
F	overall quadrant		
G	overall omega		
H	overall alpha		
I	overall radial dist ft		
J	outlier indicator		
K	cluster quadrant		
L	cluster omega		
M	cluster alpha		
N	outlier radius, ft		
O	area, sq mi		
P	aspect ratio		
Q	spare		
R	density, lines/sq mi		
S	Rock Depth		
T	Rock Hrdns		
U	Surf Tex		
V	Wtr Tbl Dpth		
W	tot lines		
X	total business lines		
Y	residential lines		
Z	special access		
AA	public		
AB	single-line business		
AC	households		
AD	1-hu detach		
AE	1-hu attach		
AF	hu-2		
AG	hu-4		

Workbook: **R50\_distribution.xls**  
Worksheet: **cluster input data**

### Equation Listing

**Hatfield Model, v5.0**  
**Distribution Module**

Column	Name	Formula	Description
AH	hu-5-9		
AI	hu 10-19		
AJ	hu-20-49		
AK	hu-50+		
AL	mobile		
AM	other		
AN	businesses		
AO	employees		
AP	cluster fraction of wire center lines		
AQ	average outlier loop length		
AR	total outlier lines		

## Equation Listing

Column	Name	Formula	Description
A	CBG	=cluster input data!D2	repeats principal CBG for cluster
B	cluster	=cluster input data!E2	repeats cluster or outlier ID from cluster input data
C	Main feeder distance (ft)	=IF(P2=0,'cluster input data'!I2*COS(PI()/180*DM2)*IF(diff_sfc>1,dstnc_mult,1),0)*IF(fdr_steer_enable,fdr_rte_air,1)	Distance along main feeder route from wire center to point at which subfeeder cable departs to connect with cluster; includes adjustments for difficult surface routing increase, if selected, and for route/air ratio, if feeder steering enabled
D	Basic subfeeder distance (ft)	=IF(P2=0,'cluster input data'!I2*SIN(PI()/180*DM2)*IF(diff_sfc>1,dstnc_mult,1),0)	perpendicular distance from main feeder route to center of cluster, adjusted for difficult surface rerouting, if selected
E	Total feeder distance (ft)	=C2+D2	Calculates sum of main and subfeeder distance for cluster
F	Fiber Indicator	=IF(OR(E2>fiber_dist,E2+T2+W2+0.5*AX2+0.5*AW2/U2>max_cu_dstnc,CK2=1,DN2+DP2<DO2),1,0)	Computed value of 1 indicates fiber feeder required for this cluster; fiber required if feeder distance > fiber feeder crossover distance, max distance from wire center to extremity of cluster > maximum allowed copper distance, outliers present, or fiber+DLC costs less than estimated copper feeder life cycle costs
G	aspect ratio	=IF(AND(rect_clustr_switch,'cluster input data'!P2>0),'cluster input data'!P2,1)	selects input aspect ratio if rectangular cluster calculations are enabled; otherwise, makes clusters square
H	Rock placement multiplier	=IF(rock_hrdns="HARD",hard_plc_mult,soft_plc_mult)	Selects hard rock factor when shown in cluster input data, otherwise inserts soft rock factor for use in calculation of rock multiplier
I	Rock multiplier adjusted for depth	=IF(OR(ISBLANK(rock_depth),rock_depth>bdrock_thresh),1,(H2-(H2-1)/bdrock_thresh*rock_depth))	Adjusts rock multiplier linearly with bedrock depth; if bedrock is below placement depth, the factor is unity; at zero depth, the factor is the basic placement factor in column H
J	Difficult surface multiplier	=IF(ISBLANK('cluster input data'!U2),1,IF(ISNA(VLOOKUP('cluster input data'!U2,surf_text,2,FALSE))),1,VLOOKUP('cluster input data'!U2,surf_text,2,FALSE)))	Obtains difficult surface condition placement factor from inputs sheet.
K	Lot frontage, ft	=IF(P2=0,MAX(66,SQRT(0.5*O2)),0)	The width of a lot, which is equal to The maximum of 66 feet OR If the Subcluster Indicator is 0, the square root of half an average lot area Computes lot frontage in feet from average lot size using assumption that depth is twice the frontage

Workbook: R50\_distribution.xls  
Worksheet: calculations

## Equation Listing

Hatfield Model, v5.0  
Distribution Module

Column	Name	Formula	Description
L	lot depth, ft	=2*K2	computes lot depth as twice the frontage
M	Households	=cluster input data!AC2	repeats household count from cluster input data
N	Businesses	=cluster input data!AN2	Repeats total business line count from cluster input data
O	Average cluster lot size, sq ft	=cluster input data!O2/Q2*5280^2	This is the smaller of: The maximum lot size, OR Computes average lot size from cluster area in cluster input data and computed estimate of subscriber locations within cluster
P	outlier indicator	=IF('cluster input data'!J2=1,1,0)	indicates whether record pertains to cluster or outlier
Q	Total locations	=hh_det+0.5*(hh_att+hh_2+hh_4+hh_59+hh_1019+hh_2049+hh_mob+hh_other+fi rms)+hh_50/4	Estimates effective number of subscriber locations by weighting different housing types
R	Lines	=lines_adj	total lines, including special access, in cluster or outlier
S	backbone length divisor/RT multiplier	=MAX(1,CEILING((MAX(0,2640*SQR(clustr_area*aspect)-depth)/(0.5*max_cu_dstnc)),1))	backbone cable length divisor, normally unity, computed whenever backbone distance exceeds one-half the user-set maximum cable distance; used to ensure copper distances do not exceed maximum; application divides the length of each backbone cable and increases the number of cables (there are normally two)
T	Backbone cable length	=IF(AND(P2=0,V2>2),MAX(0,2640*SQR(clustr_area*aspect)-depth)/S2,0)*IF(diff_sfc>1,dstnc_mult,1)	Computes backbone cable distance as distance from center of cluster to point one lot depth from cluster boundary; includes adjustment for aspect ratio if enabled, allowing rectangular clusters
U	branch length divisor/RT multiplier	=MAX(1,CEILING((MAX(0,2640*SQR(clustr_area/aspect)-front_lot)/(0.5*max_cu_dstnc)),1))	branch cable length divisor, normally unity, computed whenever branch distance exceeds one-half the user-set maximum cable distance; used to ensure copper distances do not exceed maximum; application of factor increases number of branch cables and corresponding shortens each
V	number of branches (per cluster)	=IF(P2=0,CEILING(5280*SQR(clustr_area*aspect)/(2*depth),1),0)*U2*2	computes the number of branch cables in a cluster; branch cables extend from the backbone to either side to a point one lot width from edge of cluster
W	branch length	=IF(AND(Q2>2,P2=0),MAX(0,2640*SQR(clustr_area/aspect)-front_lot)/U2,0)*IF(diff_sfc>1,dstnc_mult,1)	Distance from the backbone cable to the edge of the occupied cluster area, less one lot width; includes aspect ratio factor which allows computation of rectangular clusters