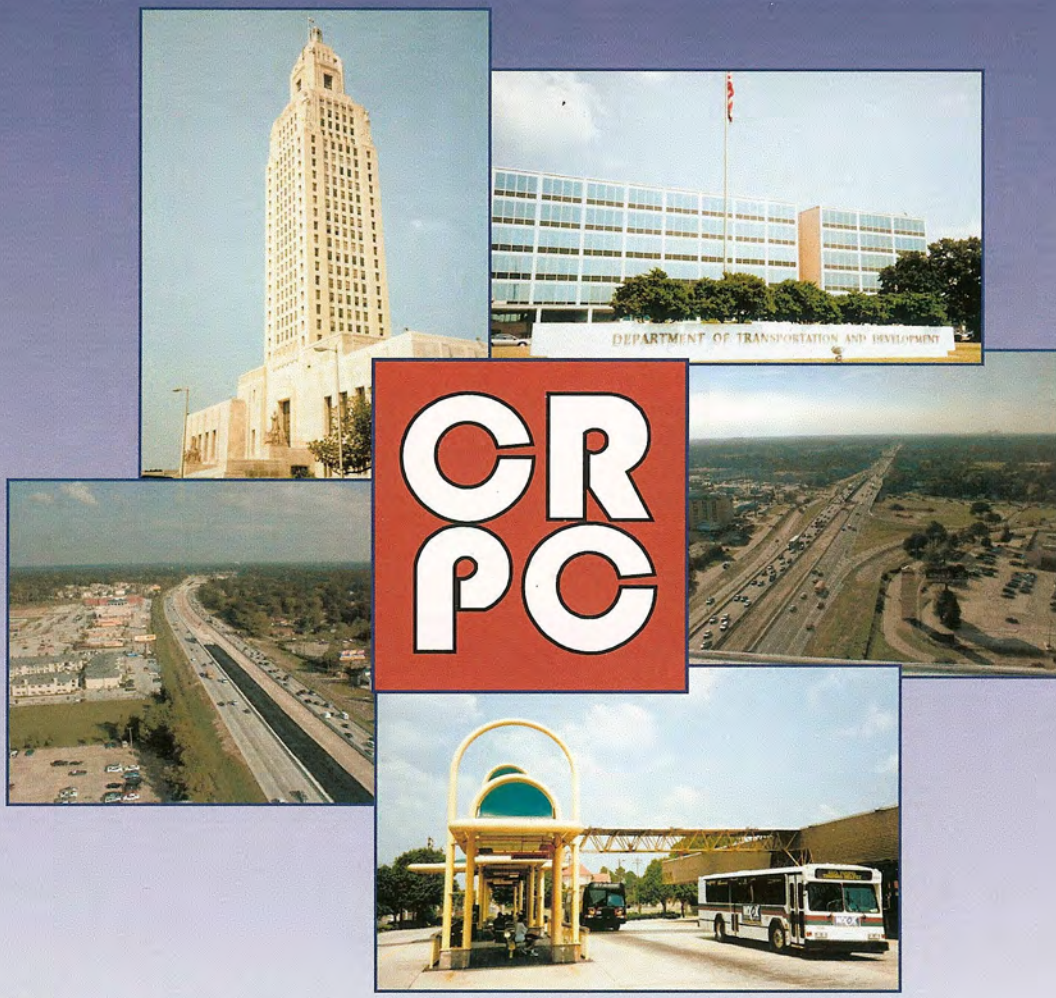
Draft Preliminary Implementation Plan for Intelligent Transportation Systems for the Baton Rouge Transportation Management Area



CAPITAL REGION
PLANNING COMMISSION
333 N. 19TH ST., P.O. BOX 3355, BATON ROUGE, LA. 70821

Prepared By:
URS Greiner Woodward Clyde
In association with:
Higgins Engineers

DRAFT
"PRELIMINARY IMPLEMENTATION PLAN"

FOR

INTELLIGENT TRANSPORTATION SYSTEMS
FOR THE BATON ROUGE
TRANSPORTATION MANAGEMENT AREA

State Project No. 736-17-0309
FAP No. CM-5006 (037)
Baton Rouge TMA

Prepared for the:

Capital Region Planning Commission

January 1999

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

1.0 Implementation Plan Components

The following documents the "Preliminary Implementation Plan" which has been developed in accordance with "Attachment A, Supplemental Scope of Services for Development of a Preliminary Implementation Plan for the Baton Rouge TMA Advanced Traffic Management System for Early Deployment of Intelligent Transportation Systems". The above referenced Supplemental Scope of Services was developed consistent with the "Implementation Plan" requirements documented in 23 CFR 655.409(f). The purpose is to address key issues and document strategies, methods and agreements which will be utilized to implement and operate the planned ITS Deployment as defined in the "ITS Early Deployment Plan" for the Baton Rouge TMA, including system design issues, procurement methods, institutional arrangements, and personnel and budget resources.

1.1 Deployment Approach

During the project design phase, as the full implications of using specific hardware/software systems come more into focus, it may be necessary to rethink some of the decisions reflected in prior planning. It is fully appropriate, in fact, it should be viewed as a responsibility, to make trade-offs and appropriate changes in the project at that point in the project development process.

There are two general approaches typically taken in deploying advanced transportation management systems, the full deployment approach and the staged project approach. Under the full deployment approach the entire Advanced Traffic Management System (ATMS) is deployed under one construction contract.

The "Staged" project approach entails an incremental deployment, in which separate contracts are awarded for the construction of a number of stand-alone subsystems, which when completed, will comprise the comprehensive ATMS.

The "Full Deployment" approach requires higher levels of annual funding, which are often difficult to secure, and the operating staff must be capable of immediately operating the entire system all at once with no time for staff to grow into that level of operation through operating smaller, less complex subsystems.

Due to limited financial resources and the limited ITS operations expertise, the "Staged" implementation process will be utilized for ITS deployment in the Baton Rouge TMA consistent with the ITS Early Deployment Plan.

The "Staged" or "Incremental" approach includes construction of a series of projects, each consisting of a stand-alone subsystem capable of delivering benefits, under separate contracts over a period of time. Each subsequent subsystem is integrated with those that have preceded it, evolving into a comprehensive ATMS. Under this approach, available funding level concerns are minimized as projects are implemented over a period of time consistent with available funding levels. There is also the opportunity to select the most visible and beneficial projects of which there is a high probability of early success. Systems also come on-line at a more manageable pace. The advantages associated with this "Staged" or "Incremental" approach include the following:

- Ability to implement the program in phases consistent with funding levels.
- Allows staff skills and operational procedures to evolve over time, beginning with minimized complexity and evolving into a more sophisticated operational system.
- This concept also allows for the building of inter-agency working relationships concurrent with the evolution of the system.
- Concepts of ITS freeway and incident management are allowed to grow and mature as the overall system evolves.
- Traffic management measures are introduced to the public in smaller, perhaps more acceptable, increments.
- As the initial system evolves, realistic accounts of maintenance requirements, reliability of system equipment, and system Operations and Maintenance (O&M) costs are determined allowing for better evaluations of future deployment.

1.2 System Designer

Due to the complexity of the system and in-house expertise constraints, Consultant Services will be utilized. In order to meet the proposed schedule for implementation of Phase I of the Freeway Management Component (LA 1 to the I-10/I-12 Interchange), it is recommended that the procurement process for a System Manager (see Procurement Methods, *Section 2.0*) begin in the early spring of 1999. At that point, both the Early Deployment Study and the Preliminary Implementation Plan will be finalized. Items which should be included in the scope of work for the System Manager, are as follows:

- Development of plans and specifications for field deployment of equipment including:
  - ❑ CCTV cameras and associated structures.
  - ❑ Vehicle detection stations.
  - ❑ Variable message signs and associated structures.
  - ❑ Cabinets and controllers.
  - ❑ Power distribution systems.
  - ❑ Required communications equipment and distribution system.

- System Integration – The System Manager will also be responsible for system integration including specification of hardware and associated firmware at the Traffic Management Center for operation of equipment deployment in the field as well as development of project specific software as required for system integration.

- Development of operational guidelines in cooperation with the Advisory Committee, (See *Section 3.0*) and to provide training for systems operation to ATMS staff.

1.3 System Design Life

The ITS Early Deployment Study proposes implementation of the Baton Rouge ITS system over the next 20 years (1998 – 2018), with the majority of the ITS infrastructure being implemented in the initial 10 year period depending on the availability and programming of financial resources. While the functional operating life of the proposed ITS System for deployment may exceed 30 years, this time frame was utilized as a reasonable estimate of the functional operating life of the system to calculate projected returns on investment. For purposes of this Preliminary Implementation Plan, the analysis period will begin in the year 1998, and extend through year 2027. Utilizing a 30 year design life and project costs from the ITS Early Deployment Study, an economic analysis was preformed to identify ranges of reasonable projected returns for the investment.

1.3.1 Preliminary Benefits to Costs Analysis of ITS Deployment

As noted in the ITS Early Deployment Plan, benefits are anticipated in the forms of reduced crashes and corresponding fatalities, bodily injuries, property damages, travel-time savings and increased throughput and user satisfaction. Not all of the benefits anticipated by the deployment of an ITS System in Baton Rouge can be readily quantified. Some benefits (e.g., user satisfaction and psychological benefits from reduced traffic) can only be qualitatively described, and still other benefits (e.g., the reductions in fatalities from reducing the response times of emergency personnel at accident scenes) are difficult to estimate.

The most important anticipated benefit from the deployment of an Advanced Traffic Management System (ATMS) in Baton Rouge is enhanced safety of vehicle occupants. Enhanced safety can be described by reduced fatality and bodily injury rates on major corridors. Accident reduction rates associated with the deployment of freeway management systems, ramp meters and other ITS components for various municipalities in the United States are provided in the Baton Rouge ITS Early Deployment Plan. These accident-reduction rates range between 5 and 50 percent for freeway management systems and other ATMS components on freeways.[1] Additionally, based on another source, it is estimated that accident rates could be reduced by as much as 20 percent on arterials from the implementation of the advanced traffic signalization.[2] The benefits estimate completed for the deployment of the Baton Rouge ATMS utilized accident reduction rates on freeways, US 190 and US 190/61, assumed to be between 5 and 10 percent, where 5 percent was the conservative scenario and 10 percent is the more moderate scenario. The accident reduction rates on uncontrolled-access (full-access) facilities was assumed to be either 5 percent (conservative) or 10 percent (moderate). These rate ranges were used as a sensitivity analysis to provide a reasonable series of projected benefits associated with ITS deployment. The analysis determined that the benefits and associated benefits to costs ratio are very sensitive to changes in the assumed accident reduction rates.

Accidents or crashes result in property damages and sometimes bodily injuries and/or fatalities. The Federal Highway Administration (FHWA) regularly reviews the benefits of highway improvements using 1) empirically-derived accident-reduction rates for different types of highway improvements and 2) monetary value assumptions for each incident type as listed in *Table 1.1*

[1] FHWA. 1997. ITS Benefits: *Continuing Success and Operational Test Results*. p. xi.
[2] Kentucky Transportation Research Program. 1985. *Development of Accident Reduction Factors*. Research Report UKTRP-85-6.p. 64.

Table 1.1 – Estimated Costs of Highway Crashes

Incident Severity	Average Estimated Value Per Person in 1998	Average Estimated Value Per Accident in 1998
Property Damage Only	$2,254	$5,836
Bodily Injuries	$60,262	$90,470
Fatality	$3,110,565	$3,539,312

Note: Costs were adjusted from 1988 dollars to 1998 dollars with the gross domestic product price deflator ratio (1998:1988) for this period.
Source: FHWA. 1991. The Costs of Highway Crashes. Publication No. FHWA-RD-91-055, June. Technical Summary.

Accident rates for State-maintained roadways within the boundaries of the study area were obtained for the period between 1993 and 1996. These comprised the majority of the major Baton Rouge arteries. Data was averaged over this time period by the following categories: 1) accidents resulting in property damages only; 2) accidents resulting in bodily injuries, and 3) accidents resulting in fatalities.

Aggregate average number of accidents on this partial network (i.e., excluding the streets maintained by the City of Baton Rouge) during this period was assumed to sufficiently represent the projected number of accidents on this network in the year 2001, the first year of anticipated benefits of the Baton Rouge ITS deployment. Accident reduction factors associated with ITS deployment as previously discussed were applied to these costs, by incident type. The estimated number of reduced incidents, by type of incident, were then valued by applying the per incident costs displayed in *Table 1.1*. Resulting reductions in societal costs of fatalities, injuries, and property damages (i.e., societal benefits) were then extrapolated into the future by applying the average annual traffic growth rate for the Baton Rouge metropolitan area. This extrapolation of accident reduction benefits implicitly assumes that the projected growth in anticipated accidents will be directly related and equal to the growth of traffic (2 percent per year) and that accident increases will be proportional among the incident types noted in *Table 1.1* throughout the projection period.

The benefits of reduced travel time associated with the deployment of an ATMS in Baton Rouge would be comprised of two components: 1) increased average travel speed resulting from increased driver intelligence regarding route delays, from ramp meter deployment, and the deployment of advanced traffic signalization; and 2) decreased non-recurring congestion associated with quicker and more efficient incident verification and deployment of incident management personnel (i.e., ambulances, police, tow trucks, assistance vehicles, and others) to traffic incidents resulting in improved clearance times. It is difficult to estimate the differential effects of these two ITS components. However, based on past studies noted in the Baton Rouge ITS Early Deployment Plan, advanced incident management can result in substantial delay savings relative to non-recurring congestion. For this analysis, an aggregate time savings factor was assumed and arbitrarily distributed between these two components in order to illustrate that time savings would be a function of both components.

Delay for the entire network was estimated using the difference between the average peak travel times through all segments of network roadways and the average off-peak travel times through all segments of network roadways as documented by the Louisiana State University report titled, *Development of a Congestion Management System Using GPS Technology* (November 1996). Estimated delay by segment was aggregated into a total daily vehicular delay for the transportation network within the study area boundary. It was assumed that the average occupancy rate per vehicle is 1.3 persons and that the hourly value of each person's time equals an average hourly rate of $11.00, as based on 1996 annual per capita income for East Baton Rouge Parish.[3] It was further estimated that delay savings associated with ITS deployment would be large in the aggregate but relatively small per person. Because small time savings (i.e., 1 to 5 minutes) cannot be used productively by the average person and has, therefore, a low opportunity cost, a percentage of the average hourly value of time (as opposed to the entire [100 percent] hourly value of time, $11) was used to determine the associated benefits of travel time savings to vehicle occupants. Using the American Association of State Highway and Transportation Officials' manual titled, *A Manual on User Benefit Analysis of Highway and Bus-Transit Improvements* (1975), it was assumed that the small time savings realized by vehicle occupants could be valued at 2.8 percent of the hourly wage, or $0.28 per hour. This conservative estimate was applied to the estimated aggregate delay and associated delay reduction to develop a travel timesaving value for a conservative scenario. The full value of the average hourly wage ($11) was used in calculations for the moderate scenario (*Table 1.3*).

Benefits were aggregated by year and adjusted to their present value using a discount rate. The discount rate is a rate that adjusts the value of money at different time intervals for aggregation and/or comparison within a single time interval. It reflects the real cost of capital of the investment and is based on the simple axiom that a dollar is worth more to an individual/entity this year than it is worth to that same individual/entity next year. Several discount rates were used in the analysis for comparison purposes. These ranged from a conservative 7 percent to a more realistic 4 percent. Analysis results were relatively insensitive to the discount rate used within this range.

Costs associated with the ITS deployment are projected among the project years by phase (Near Term, Mid Term, and Long Term) as described in the Baton Rouge ITS Deployment Plan, and by type (investment versus operations/maintenance costs). Costs, by year, were aggregated for comparison to the benefits summary. Only public expenditures were considered for this analysis, which implicitly assumes that all benefits projected in the analysis would be solely attributable to the public investments and operations noted in the analysis and not attributable to private consumer purchases, which are not accounted for in this analysis. Although private investments of equipment would be purchased by consumers through the purchase of future, already-equipped vehicles or after-market equipment packages, the conservative accident reduction rates and travel time saving assumptions made for this analysis provide some latitude for the omission and difficult-to-estimate private consumer costs. As completed for the projected benefits, costs for different years in the project period were adjusted to the present value for comparison in one project year.

[3] U.S. Department of Commerce. Table CA 30, Regional Economic Profiles, Bureau of Economic Analysis. Washington, D.C.Obtained from the Internet in January 1999.

Discounted benefit and cost streams for the projection period (30 years) were then aggregated and compared to one another, resulting in a ratio of the discounted, projected benefits of the project to the discounted, projected costs of the project. Based on the sensitivity analyses conducted using different accident reduction rates and discount rates, the anticipated benefit to cost ratio for the Baton Rouge ITS Deployment is projected to range between 3.8 (conservative) and 9.4 (moderate) as noted in *Tables 1.2 and 1.3*. This resulting ratio may be simplified and interpreted to read that for every public dollar spent on the ITS deployment, society would realize between $3.80 and $9.40 dollars of benefit.

It should be noted that several benefits and costs were not estimated and incorporated into these preliminary benefits to costs analysis conducted for the Baton Rouge ITS Deployment. Although time savings benefits associated with improved incident management coordination was estimated, the associated reduction in fatalities due to more rapid emergency response was not estimated. Additionally, the time savings benefits to riders of Mass Transit (buses) was not estimated, and the potential decreases in long term automobile insurance premiums was not estimated. Finally, the salvage value of equipment and property for the ITS at the end of the project analysis period (a 30-year horizon) was not calculated or included as a benefit for this analysis, because, among other reasons, most equipment is computer equipment that depreciates much more rapidly than other capital.

The only reasonably foreseeable costs that were not estimated and incorporated into this analysis were the private, consumer equipment purchases that will be necessary to gain the full benefits of the proposed ITS system in the Mid-and Long Terms and the opportunity cost associated with the expenditures of funds on the Baton Rouge ITS. Opportunity costs are the net benefits of the next best alternate use of project funds. In many investment decisions, this opportunity cost is the return on a stock, bond, or other interest-bearing investment. By using the noted funds on ITS deployment, other productive uses of these monies would be foregone. No attempts to evaluate competing projects for these monies were made for this analysis; therefore, no opportunity costs of this investment can be reasonably estimated.

Despite these exclusions and corresponding limitations, this cursory analysis of projected accident reduction and time savings benefits, and public expenditures suggests that the deployment of the proposed ITS system is likely to be of greater benefit to society than cost to society.

Table 1.2. Benefits to Costs Comparison
Conservative Scenario

EARLY DEPLOYMENT PLAN
ITS EARLY DEPLOYMENT STUDY
Baton Rouge TMA
C3-46903

		Benefits Summary: Freeways/US 190/US 61			Benefits Summary: Full-Access Facilities								Costs Summary: Capital Investments							Evaluation	
Project Year	Year	Reductions in Property Damages	Reductions in Bodily Injuries	Reductions in Traffic-Related Fatalities	Reductions in Property Damages	Reductions in Bodily Injuries	Reductions in Traffic-Related Fatalities	Recurrent Congestion Travel Time Savings	Non-Recurrent Congestion Travel Time Savings	Subtotal Benefits	Discounted Benefits	Discounted Cumulative Benefit	Near Term	Mid Term	Long Term	Operations & Maintenance	Subtotal Costs	Discounted Costs	Discounted Cumulative Costs	Net Cumulative Value	Cumulative Net Present Value
1	1998	0	0	0	0	0	0	0	0	0	0	0	2,000,000	0	0	0	2,000,000	1,869,159	1,869,159	-2,000,000	-1,869,159
2	1999	0	0	0	0	0	0	0	0	0	0	0	7,185,000	0	0	0	7,185,000	6,275,657	8,144,816	-7,185,000	-8,144,816
3	2000	0	0	0	0	0	0	0	0	0	0	0	8,858,000	0	0	85,000	8,943,000	7,300,152	15,444,968	-8,943,000	-15,444,968
4	2001	801,096	7,148,520	1,982,985	732,745	6,334,237	1,827,457	8,600	8,600	18,844,240	14,376,181	14,376,181	3,701,000	0	0	325,000	4,026,000	3,071,416	18,516,384	14,818,240	-4,140,203
5	2002	817,118	7,291,491	2,022,645	747,400	6,460,922	1,864,006	8,815	8,815	19,221,211	13,704,458	28,080,639	4,818,000	0	0	400,000	5,218,000	3,720,362	22,236,746	14,003,211	5,843,893
6	2003	833,460	7,437,321	2,063,098	762,348	6,590,140	1,901,286	9,036	9,036	19,605,724	13,064,121	41,144,760	5,610,000		0	637,500	6,247,500	4,162,973	26,399,719	13,358,224	14,745,041
7	2004	850,129	7,586,067	2,104,359	777,595	6,721,943	1,939,312	9,262	9,262	19,997,928	12,453,705	53,598,465	0	2,333,000	0	733,250	3,066,250	1,909,506	28,309,226	16,931,678	25,289,240
8	2005	867,132	7,737,788	2,146,447	793,147	6,856,382	1,978,098	9,493	9,493	20,397,980	11,871,810	65,470,275	0	5,456,000	0	733,250	6,189,250	3,602,200	31,911,425	14,208,730	33,558,850
9	2006	884,474	7,892,544	2,189,376	809,010	6,993,509	2,017,660	9,730	9,730	20,806,034	11,317,104	76,787,379	0	7,064,000	0	733,250	7,797,250	4,241,187	36,152,613	13,008,784	40,634,766
10	2007	902,164	8,050,395	2,233,163	825,190	7,133,380	2,058,013	9,974	9,974	21,222,252	10,788,317	87,575,696	0	6,268,000	0	865,500	7,133,500	3,626,310	39,778,922	14,088,752	47,796,773
11	2008	920,207	8,211,403	2,277,826	841,694	7,276,047	2,099,173	10,223	10,223	21,646,797	10,284,237	97,859,933	0	8,311,000	0	865,500	9,176,500	4,359,689	44,138,611	12,470,297	53,721,322
12	2009	938,611	8,375,631	2,323,383	858,528	7,421,568	2,141,157	10,479	10,479	22,079,835	9,803,711	107,663,644	0	0	990,000	988,100	1,978,100	878,300	45,016,912	20,101,735	62,646,732
13	2010	957,384	8,543,144	2,369,851	875,698	7,569,999	2,183,980	10,741	10,741	22,521,537	9,345,637	117,009,281	0	0	3,195,000	988,100	4,183,100	1,735,838	46,752,749	18,338,437	70,256,532
14	2011	976,531	8,714,007	2,417,248	893,212	7,721,399	2,227,660	11,009	11,009	22,972,075	8,908,967	125,918,248	0	0	5,264,000	988,100	6,252,100	2,424,672	49,177,421	16,719,975	76,740,826
15	2012	996,062	8,888,287	2,465,593	911,076	7,875,827	2,272,213	11,284	11,284	23,431,626	8,492,700	134,410,947	0	0	494,000	1,092,000	1,586,000	574,839	49,752,261	21,845,626	84,658,686
16	2013	1,015,983	9,066,052	2,514,904	929,298	8,033,344	2,317,657	11,566	11,566	23,900,372	8,095,833	142,506,630	0	0	104,000	1,092,000	1,196,000	405,127	50,157,387	22,704,372	92,349,443
17	2014	1,036,303	9,247,373	2,565,202	947,884	8,194,011	2,364,010	11,856	11,856	24,378,495	7,717,607	150,224,437	0	0	5,000,000	1,092,000	6,092,000	1,928,571	52,085,959	18,286,495	98,138,479
18	2015	1,057,029	9,432,321	2,616,507	966,842	8,357,891	2,411,290	12,152	12,152	24,866,183	7,357,006	157,581,444	0	0	500,000	1,092,000	1,592,000	471,015	52,556,974	23,274,183	105,024,470
19	2016	1,078,169	9,620,967	2,668,837	986,178	8,525,049	2,459,516	12,456	12,456	25,363,628	7,013,255	164,594,698	0	0	500,000	1,092,000	1,592,000	440,201	52,997,175	23,771,628	111,597,523
20	2017	1,099,733	9,813,387	2,722,213	1,005,902	8,695,550	2,508,706	12,767	12,767	25,871,026	6,685,565	171,280,263	0	0	500,000	1,092,000	1,592,000	411,403	53,408,578	24,279,026	117,871,684
21	2018	1,121,727	10,009,654	2,776,658	1,026,020	8,869,461	2,558,881	13,086	13,086	26,388,574	6,373,186	177,653,449	0	0	500,000	1,092,000	1,592,000	384,489	53,793,067	24,796,574	123,860,382
22	2019	1,144,162	10,209,847	2,832,191	1,046,540	9,046,850	2,610,058	13,414	13,414	26,916,476	6,075,403	183,728,852	0	0	5,000,000	1,092,000	6,092,000	1,375,045	55,168,112	20,824,476	128,560,740
23	2020	1,167,045	10,414,044	2,888,835	1,067,471	9,227,787	2,662,259	13,749	13,749	27,454,940	5,791,534	189,520,386	0	0	500,000	1,092,000	1,592,000	335,827	55,503,939	25,862,940	134,016,446
24	2021	1,190,386	10,622,325	2,946,611	1,088,821	9,412,343	2,715,505	14,093	14,093	28,004,176	5,520,929	195,041,314	0	0	500,000	1,092,000	1,592,000	313,857	55,817,797	26,412,176	139,223,518
25	2022	1,214,194	10,834,772	3,005,544	1,110,597	9,600,590	2,769,815	14,445	14,445	28,564,400	5,262,967	200,304,282	0	0	500,000	1,092,000	1,592,000	293,325	56,111,121	26,972,400	144,193,160
26	2023	1,238,478	11,051,467	3,065,654	1,132,809	9,792,602	2,825,211	14,806	14,806	29,135,833	5,017,059	205,321,341	0	0	500,000	1,092,000	1,592,000	274,135	56,385,256	27,543,833	148,936,084
27	2024	1,263,247	11,272,497	3,126,967	1,155,465	9,988,454	2,881,715	15,176	15,176	29,718,698	4,782,641	210,103,982	0	0	5,000,000	1,092,000	6,092,000	980,388	57,365,644	23,626,698	152,738,337
28	2025	1,288,512	11,497,947	3,189,507	1,178,574	10,188,223	2,939,349	15,556	15,556	30,313,223	4,559,176	214,663,157	0	0	500,000	1,092,000	1,592,000	239,440	57,605,085	28,721,223	157,058,073
29	2026	1,314,282	11,727,905	3,253,297	1,202,146	10,391,987	2,998,136	15,945	15,945	30,919,643	4,346,152	219,009,310	0	0	500,000	1,092,000	1,592,000	223,776	57,828,861	29,327,643	161,180,449
30	2027	1,340,568	11,962,464	3,318,363	1,226,189	10,599,827	3,058,099	16,343	16,343	31,538,196	4,143,082	223,152,391	0	0	500,000	1,092,000	1,592,000	209,136	58,037,997	29,946,196	165,114,394
Total	NA	28,314,186	252,659,621	70,087,262	25,898,379	223,879,321	64,590,221	326,055	326,055	666,081,102	223,152,391	223,152,391	32,172,000	29,432,000	30,547,000	25,814,550	117,965,550	58,037,997	58,037,997	548,115,552	165,114,394

Notes:

Benefits most sensitive to fluctuations in Accident Reduction Rate. Accident reduction estimates do not include City-maintained roads.
Accident reduction benefits extrapolated by using assumed traffic growth rate. Accident rates for period of 1993-1996 are assumed to be representative for year 2001.
Assumes operations and maintenance costs of $1.09 million, respectively, for years, 2014-2037 (project years 17-40).
References for Accident Reduction Rates attributable to ITS implementation and other benefits are provided in the main text of the report.
Assumptions and results of analysis in bottom right corner of this page. B/C refers to benefits divided by costs.

Sources:

LDOTD, Traffic Incident Data for 1993-1996, Selected State Routes. Obtained from LDOTD Traffic Planning Division in December 1998;
Federal Highway Association. Technical Summary for The Costs of Highway Crashes. Publication No. FHWA-RD-91-055. USDOT, FHWA Research Center: McLean, VA., June 1991.

Assumptions and Results:

Discount Rate:	7.0%
Accident Reduction Rates:	
Freeway Mgt. (ATIS/ATMS)	5.0%
Full-Access Mgt. (Signal Imp.)	5.0%
Travel Time Reduction:	
Recurrent Congestion:	2.5%
Non-Recurrent Congestion	2.5%
Travel Time Reduction (IMC):	
Growth of Traffic:	2.0%
Persons Per Vehicle	1.3
Delay-days/year	251
Hourly Value of Time	$11.0
Percent of Hourly Time	2.8%
Adjusted Value of Hourly Time	$0.31
B/C at 30 Years	**3.84**

its_bc3.xls

2/9/99

Table 1.3. Benefits to Costs Comparison
Moderate Scenario

EARLY DEPLOYMENT PLAN
ITS EARLY DEPLOYMENT STUDY
Baton Rouge TMA
C3-46903

		Benefits Summary										
		Freeways/US 190/US 61			Full-Access Facilities							
Project Year	Year	Reductions In Property Damages	Reductions In Bodily Injuries	Reductions in Traffic-Related Fatalities	Reductions In Property Damages	Reductions In Bodily Injuries	Reductions in Traffic-Related Fatalities	Recurrent Congestion Travel Time Savings	Non-Recurrent Congestion Travel Time Savings	Subtotal Benefits	Discounted Benefits	Discounted Cumulative Benefit
1	1998	0	0	0	0	0	0	0	0	0	0	0
2	1999	0	0	0	0	0	0	0	0	0	0	0
3	2000	0	0	0	0	0	0	0	0	0	0	0
4	2001	3,067,682	26,965,515	7,620,883	1,465,490	12,668,474	3,654,913	614,309	614,309	56,671,574	48,443,099	48,443,099
5	2002	3,129,035	27,504,825	7,773,301	1,494,800	12,921,843	3,728,012	645,024	645,024	57,841,864	47,541,796	95,984,896
6	2003	3,191,616	28,054,922	7,928,767	1,524,696	13,180,280	3,802,572	677,275	677,275	59,037,403	46,658,117	142,643,013
7	2004	3,255,448	28,616,020	8,087,342	1,555,190	13,443,886	3,878,623	711,139	711,139	60,258,788	45,791,726	188,434,739
8	2005	3,320,557	29,188,340	8,249,089	1,586,294	13,712,763	3,956,196	746,696	746,696	61,506,632	44,942,293	233,377,032
9	2006	3,386,968	29,772,107	8,414,071	1,618,020	13,987,019	4,035,320	784,031	784,031	62,781,566	44,109,496	277,486,528
10	2007	3,454,708	30,367,549	8,582,352	1,650,380	14,266,759	4,116,026	823,232	823,232	64,084,239	43,293,016	320,779,544
11	2008	3,523,802	30,974,900	8,753,999	1,683,388	14,552,094	4,198,347	864,394	864,394	65,415,318	42,492,543	363,272,087
12	2009	3,594,278	31,594,398	8,929,079	1,717,055	14,843,136	4,282,314	907,614	907,614	66,775,488	41,707,773	404,979,860
13	2010	3,666,163	32,226,286	9,107,661	1,751,396	15,139,999	4,367,960	952,994	952,994	68,165,455	40,938,406	445,918,266
14	2011	3,739,487	32,870,812	9,289,814	1,786,424	15,442,799	4,455,319	1,000,644	1,000,644	69,585,943	40,184,148	486,102,414
15	2012	3,814,276	33,528,228	9,475,610	1,822,153	15,751,655	4,544,425	1,050,676	1,050,676	71,037,701	39,444,714	525,547,128
16	2013	3,890,562	34,198,793	9,665,123	1,858,596	16,066,688	4,635,314	1,103,210	1,103,210	72,521,496	38,719,819	564,266,947
17	2014	3,968,373	34,882,769	9,858,425	1,895,768	16,388,022	4,728,020	1,158,371	1,158,371	74,038,118	38,009,189	602,276,136
18	2015	4,047,741	35,580,424	10,055,594	1,933,683	16,715,782	4,822,581	1,216,289	1,216,289	75,588,383	37,312,551	639,588,688
19	2016	4,128,696	36,292,032	10,256,706	1,972,357	17,050,098	4,919,032	1,277,104	1,277,104	77,173,128	36,629,640	676,218,328
20	2017	4,211,269	37,017,873	10,461,840	2,011,804	17,391,100	5,017,413	1,340,959	1,340,959	78,793,216	35,960,195	712,178,523
21	2018	4,295,495	37,758,231	10,671,076	2,052,040	17,738,922	5,117,761	1,408,007	1,408,007	80,449,538	35,303,961	747,482,484
22	2019	4,381,405	38,513,395	10,884,498	2,093,081	18,093,700	5,220,116	1,478,407	1,478,407	82,143,010	34,660,685	782,143,169
23	2020	4,469,033	39,283,663	11,102,188	2,134,942	18,455,574	5,324,519	1,552,327	1,552,327	83,874,574	34,030,123	816,173,293
24	2021	4,558,413	40,069,336	11,324,232	2,177,641	18,824,686	5,431,009	1,629,944	1,629,944	85,645,205	33,412,034	849,585,327
25	2022	4,649,582	40,870,723	11,550,716	2,221,194	19,201,179	5,539,629	1,711,441	1,711,441	87,455,906	32,806,180	882,391,506
26	2023	4,742,573	41,688,138	11,781,731	2,265,618	19,585,203	5,650,422	1,797,013	1,797,013	89,307,711	32,212,330	914,603,836
27	2024	4,837,425	42,521,900	12,017,365	2,310,930	19,976,907	5,763,430	1,886,864	1,886,864	91,201,686	31,630,256	946,234,092
28	2025	4,934,173	43,372,338	12,257,713	2,357,149	20,376,445	5,878,699	1,981,207	1,981,207	93,138,931	31,059,735	977,293,827
29	2026	5,032,857	44,239,785	12,502,867	2,404,292	20,783,974	5,996,273	2,080,267	2,080,267	95,120,582	30,500,549	1,007,794,376
30	2027	5,133,514	45,124,581	12,752,924	2,452,378	21,199,654	6,116,198	2,184,281	2,184,281	97,147,810	29,952,483	1,037,746,860
Total	NA	108,425,132	953,077,884	269,354,966	51,796,759	447,758,642	129,180,443	33,583,720	33,583,720	2,026,761,265	1,037,746,860	1,037,746,860

		Costs Summary							Evaluation	
		Capital Investments								
Project Year	Year	Near Term	Mid Term	Long Term	Operations & Maintenance	Subtotal Costs	Discounted Costs	Discounted Cumulative Costs	Net Cumulative Value	Cumulative Net Present Value
1	1998	2,000,000	0	0	0	2,000,000	1,923,077	1,923,077	-2,000,000	-1,923,077
2	1999	7,185,000	0	0	0	7,185,000	6,642,936	8,566,013	-7,185,000	-8,566,013
3	2000	8,858,000	0	0	85,000	8,943,000	7,950,294	16,516,308	-8,943,000	-16,516,308
4	2001	3,701,000	0	0	325,000	4,026,000	3,441,442	19,957,749	52,645,574	28,485,350
5	2002	4,818,000	0	0	400,000	5,218,000	4,288,816	24,246,565	52,623,864	71,738,330
6	2003	5,610,000	0	0	637,500	6,247,500	4,937,490	29,184,055	52,789,903	113,458,958
7	2004	0	2,333,000	0	733,250	3,066,250	2,330,098	31,514,153	57,192,538	156,920,586
8	2005	0	5,456,000	0	733,250	6,189,250	4,522,424	36,036,577	55,317,382	197,340,455
9	2006	0	7,064,000	0	733,250	7,797,250	5,478,244	41,514,822	54,984,316	235,971,706
10	2007	0	6,268,000	0	865,500	7,133,500	4,819,137	46,333,959	56,950,739	274,445,585
11	2008	0	8,311,000	0	865,500	9,176,500	5,960,879	52,294,838	56,238,818	310,977,249
12	2009	0	0	990,000	988,100	1,978,100	1,235,515	53,530,354	64,797,388	351,449,506
13	2010	0	0	3,195,000	988,100	4,183,100	2,512,261	56,042,615	63,982,355	389,875,651
14	2011	0	0	5,264,000	988,100	6,252,100	3,610,432	59,653,047	63,333,843	426,449,367
15	2012	0	0	494,000	1,092,000	1,586,000	880,650	60,533,697	69,451,701	465,013,431
16	2013	0	0	104,000	1,092,000	1,196,000	638,554	61,172,251	71,325,496	503,094,697
17	2014	0	0	5,000,000	1,092,000	6,092,000	3,127,470	64,299,721	67,946,118	537,976,416
18	2015	0	0	500,000	1,092,000	1,592,000	785,856	65,085,577	73,996,383	574,503,111
19	2016	0	0	500,000	1,092,000	1,592,000	755,631	65,841,207	75,581,128	610,377,121
20	2017	0	0	500,000	1,092,000	1,592,000	726,568	66,567,775	77,201,216	645,610,748
21	2018	0	0	500,000	1,092,000	1,592,000	698,623	67,266,398	78,857,538	680,216,086
22	2019	0	0	5,000,000	1,092,000	6,092,000	2,570,552	69,836,951	76,051,010	712,306,219
23	2020	0	0	500,000	1,092,000	1,592,000	645,916	70,482,867	82,282,574	745,690,426
24	2021	0	0	500,000	1,092,000	1,592,000	621,073	71,103,940	84,053,205	778,481,386
25	2022	0	0	500,000	1,092,000	1,592,000	597,186	71,701,126	85,863,906	810,690,380
26	2023	0	0	500,000	1,092,000	1,592,000	574,217	72,275,344	87,715,711	842,328,493
27	2024	0	0	5,000,000	1,092,000	6,092,000	2,112,807	74,388,150	85,109,686	871,845,942
28	2025	0	0	500,000	1,092,000	1,592,000	530,896	74,919,046	91,546,931	902,374,781
29	2026	0	0	500,000	1,092,000	1,592,000	510,477	75,429,523	93,528,582	932,364,853
30	2027	0	0	500,000	1,092,000	1,592,000	490,843	75,920,367	95,555,810	961,826,493
Total	NA	32,172,000	29,432,000	30,547,000	25,814,550	117,965,550	75,920,367	75,920,367	1,908,795,715	961,826,493

Notes:

Benefits most sensitive to fluctuations in Accident Reduction Rate. Accident reduction estimates do not include City-maintained roads.
Accident reduction benefits extrapolated by using assumed traffic growth rate. Accident rates for period of 1993-1996 are assumed to be representative for year 2001.
Assumes operations and maintenance costs of $1.09 million, respectively, for years, 2014-2037 (project years 17-40).
References for Accident Reduction Rates attributable to ITS implementation and other benefits are provided in the main text of the report.
Assumptions and results of analysis in bottom right corner of this page. B/C refers to benefits divided by costs.

Sources:

LDOTD, Traffic Incident Data for 1993-1996, Selected State Routes. Obtained from LDOTD Traffic Planning Division in December 1998;
Federal Highway Association. Technical Summary for The Costs of Highway Crashes. Publication No. FHWA-RD-91-055. USDOT, FHWA Research Center: McLean, VA., June 1991.

Assumptions and Results:

Discount Rate:	4.0%
Accident Reduction Rates:	
Freeway Mgt. (ATIS/ATMS)	10.0%
Full-Access Mgt. (Signal Imp.)	10.0%
Travel Time Reduction:	
Recurrent Congestion:	5.0%
Non-Recurrent Congestion	5.0%
Travel Time Reduction (IMC):	
Growth of Traffic:	2.0%
Persons Per Vehicle	1.3
Delay-days/year	251
Hourly Value of Time	$11.0
Percent of Hourly Time	100.0%
Adjusted Value of Hourly Time	$11.00
B/C at 30 Years	13.67

its_bc3.xls

2/9/99

1.4 System Coverage

The system coverage identified in the Baton Rouge ITS Early Deployment Plan (20 year horizon) incorporated two main transportation networks, the interstate system and primary arterial streets. The ITS freeway and incident management system is primarily geared toward the interstate network. Advanced surface street control is typically associated with the arterial street system. The system coverage defined in the ITS Early Deployment Plan over the 20 year horizon for the interstate system is as follows:

- **I-10** – fully instrumented from LA 1 to Seigen Lane with remote capabilities extending to LA 415 to the west and Highland Road to the east.
- **I-12** – fully instrumented from the I-10/I-12 interchange to O'Neal Lane with extended remote capabilities to Range Avenue to the east.
- **I-110** – fully instrumented from the I-10/I-110 interchange to Harding Boulevard with remote capabilities to Scenic Highway.
- **US 190/61** (Airline Highway) – while US 190/61 is not an interstate highway, due to substantial traffic volumes, significant congestion, and numerous grade separations (semi-controlled access) this roadway was identified to be fully instrumented from I-12 to LA 1 with remote capabilities in the vicinity of the LA 415 intersection.

Arterial street coverage defined in the ITS Early Deployment Study over the next 20 years is inclusive of the corridors identified as part of the Advanced Surface Street Control upgrade and integration program. (See *Appendix "A"* for a listing of corridors.) Arterial street coverage includes all designated Congestion Management System corridors within the Baton Rouge TMA and other identified primary diversion routes.

The system design life designated in *Section 1.3* is 30 years, with the system design life extending through the year 2027. While no planning or funding has been programmed, there is the potential for system expansion beyond the deployment documented in the ITS Early Deployment Plan over the next 30 years. Primary candidate routes for expansion of the Freeway and Incident Management Systems include extending coverage eastward along I-12 to LA 447 and eastward along I-10 into Accension Parish. Any further expansion of the Advanced Surface Street Control System would be consistent with the Congestion Management Systems planning process and future incident management planning efforts relative to diversion routes.

There are two (2) ongoing studies relative to ITS deployment within and/or adjacent to the defined coverage area: 1) the Commercial Vehicle Operations (CVO) Study, New Orleans to San Antonio and 2) ongoing planning efforts to deploy a Motorist Information System (dynamic message signs) adjacent to elevated sections of I-10 between Baton Rouge and Lafayette.

The first phase of the CVO Study which was sanctioned by FHWA in cooperation with LDOTD and TXDOT is complete with a Phase II of the study being initiated. The focus of the study was to enhance CVOs via ITS systems deployment in the I-10 corridor between San Antonio and New Orleans. As previously stated in the ITS Early Deployment Study, ITS CVO initiatives are primarily statewide initiatives and typically not specific to any one urban area or region. However, CVO ITS Market Packages do have relationships to local and regional ITS systems.

While no specific CVO ITS deployment recommendations were established in the first phase of the CVO study, future recommendations may include deployment of ITS CVO Market Packages affecting Interstate 10 and the segments within the Baton Rouge TMA. Considering this and the importance of efficient CVO operations within the region, the Baton Rouge area-wide ITS architecture has been developed as an open, interoperable system to accommodate the following prioritized statewide CVO ITS Market Packages: CV Administrative Process, Electronic Clearance, Weigh-In-Motion, Hazmat Management, and Fleet and Freight Administration.

As part of the ITS planning process for implementation, the MPO for the region, CRPC, the City/Parish and LDOTD will participate and/or actively attend stakeholder meetings and provide input into the development of the second phase of the CVO Study of I-10 from New Orleans to San Antonio. ITS CVO recommendations adopted by State Administrative, Regulatory and Enforcement agencies, where applicable, will be integrated into the Baton Rouge area-wide ITS program.

The second related ITS planning initiative is development of a motorist information system using dynamic message signs (DMS) for the segment of I-10 from Lafayette to Baton Rouge, which is being considered by the LDOTD. While no final implementation decisions have been made relative to the exact location, type and communications to be utilized, serious consideration is being given to this concept due to the potential for hazardous weather conditions and incidents on this lengthy elevated section of I-10 and the limited points for access and exit. LDOTD is currently considering the location from which this motorist information system would be operated. One option is to operate the remotely located DMS from the proposed Traffic Management Center on Harding Boulevard, utilizing wireless communications. Several remotely located DMS along the interstate system within the Baton Rouge TMA are planned for deployment as part of the ITS Early Deployment Plan. Provisions have been made to operate these signs from the ATM-EOC on Harding Boulevard. The ability to remotely operate additional DMS deployed on I-10 between Baton Rouge and Lafayette from the ATM-EOC can be accommodated utilizing the defined operations and staffing scenario identified in *Section 4.0.* The LDOTD will work closely with the Baton Rouge ATM-EOC operations personnel to assure interoperability and compatibility with planned deployments and operations of the Baton Rouge Advanced Traffic Management System.

For purposes of this Preliminary Implementation Plan, the defined coverage area commensurate with the system design life will be the deployment limits and coverage identified in the ITS Early Deployment Plan with expanded coverage of the interstate eastward along I-12 to LA 447 and eastward along I-10 through Ascension Parish. LDOTD, the City/Parish Government and CRPC will work closely together to determine if coverage should be expanded along I-10 westward past LA 415 as part of the Baton Rouge area wide ITS program.

System coverage of the arterial street system will be consistent with the arterials identified for inclusion into the Advanced Surface Street Control Plan identified in the ITS Early Deployment Plan and as included in *Appendix A*.

1.5 System Design and Operations/Maintenance Philosophies

The center of operations for the Advanced Traffic Management System (ATMS) will be the Traffic Management Center (TMC) located within the ATM-EOC on Harding Blvd.

The TMC is scheduled to open in December of 2000 concurrent with an operational "Interim ITS Surveillance and Information Dissemination System" as defined in the ITS Strategic Deployment Plan for the Baton Rouge TMA. The "Interim System" will be operated for approximately 18 to 24 months or until the "Near Term Deployment" is completed and functional.

During the "Interim Phase" the TMC will operate five days per week, Monday through Friday, from 6:00 AM to 7:00 PM. This will assure complete coverage of both the AM and PM peak traffic periods during the work week.

Once the "Near Term Deployment" along Interstate 10 from LA 1 to the I-10/I-12 interchange is complete, the TMC days of operation will be expanded to seven days per week. Weekday operations will continue from 6:00 AM to 7:00 PM, and weekend operating hours will be from 8:00 AM to 6:00 PM. This operating scenario is envisioned to continue through the mid-term. For details regarding organization, staffing, job functions and shifts refer to *Section 4.0*.

Procedures and policies relative to the management of severe weather conditions and special events will be established by the Advisory Committee (see *Section 3.0*, Institutional Issues) prior to the opening of the TMC. The ATMS Manager, who will reside at the TMC, will be responsible for both the ATMS operations and maintenance.

Maintenance of equipment, hardware and software within the TMC as well as equipment deployed in the field associated with the Freeway and Incident Management System will be provided via an agreement with a contract maintenance service provider. The provider will supply labor, parts and spare parts storage capability for preventive and general maintenance functions.

Operations and maintenance (both city and state owned signals) of the computerized traffic signal system associated with the Advanced Surface Street Control Program as defined in *Appendix A* will continue to be performed by the City/Parish Traffic Engineering Division via an existing agreement with LDOTD. The agreement will be modified as necessary to include additional signalized intersections not currently included in the existing agreement as the corridors are upgraded and integrated into the regional ITS system. Maintenance will continue to be performed from the City/Parish Traffic Engineering and Maintenance Facility on Chippewa Street. The Advanced Surface Street Traffic Control System will be fully operable from both the regional TMC on Harding Boulevard as well as from the Chippewa Facility.

1.6 System Architecture

1.6.1 Introduction

The regional, high-level system architecture for the Baton Rouge TMA was developed in the ITS Early Deployment Study. The system architecture provides the overall integrating framework for the implementation of ITS in the region.

The development of the system architecture has been accomplished through a controlled, iterative process through which the Baton Rouge needs were understood, requirements were developed and candidate solutions evaluated. The result was a conceptual system model, which is the most appropriate and effective in addressing the identified needs.

In order to ensure the interoperability of various ITS projects and programs being developed and deployed around the United States, Congress directed the USDOT to promote national ITS compatibility.

The National ITS Architecture Development Program was initiated by the USDOT in September, 1993. As a joint effort between USDOT and ITS America, its vision was to provide an architecture that would facilitate compatibility of ITS systems across the country and serve as the framework for ITS deployment over a 20-year period.

Initial development efforts provided for consensus-based input. The goal was to provide for flexibility as ITS develops over time by not creating a specific design. Instead, the National ITS Architecture Development Program sought to develop a framework that would accommodate a wide range of system designs and various levels of implementation. This was accomplished by defining key elements required for ITS functions, the allocation of functions to specific subsystems and by defining the interfaces and how information flows among and between the transportation management systems/centers, vehicles, and roadside infrastructures.

The National ITS Architecture Program has completed the development of the initial ITS architecture. The Baton Rouge architecture has been developed by the design team within the framework of the National ITS Architecture.

1.6.2 Description of the National ITS Architecture

The National ITS Architecture is a framework upon which any ITS deployment can be built. An architecture is a blueprint and guideline. In this case it is for an Intelligent Transportation System composed of multiple subsystems. The developers created its unique structure to provide for the interrelationships between the potential subsystems and the functional requirements of the subsystems for implementing the various user services.

In developing this framework it was allowed that the type of subsystems to be deployed and the user services to be supported should be deployment specific. The inclusion or exclusion of any one or multiple subsystems will not prevent this architecture from providing guidance. The architecture subsystems are broken-down into individual equipment packages, which provide specific functional requirements. The level or extent of a subsystem's deployment is determined by the specific equipment packages included in the deployment. In addition, the framework was designed to support an open-structure format, which could provide for the developed inclusion of any legacy systems and can support existing inter-jurisdictional relationships.

1.6.3 Development of the Baton Rouge System Architecture

The Baton Rouge system architecture has been developed through an iterative process of stakeholder inquiry, system investigation, system evaluation, analysis, and design. The recommendations of this architecture and the Baton Rouge ITS Deployment are based upon a joint effort between numerous stakeholders within the Baton Rouge community, the East Baton Rouge (EBR) City/Parish Government, Capital Region Planning Commission (CRPC), LDOTD and Consultant (URS Greiner Woodward Clyde).

1.6.4 Development Process

The first step toward defining the Baton Rouge ITS concept involved a "Goals and Objectives" workshop. Statistical results of this workshop helped to identify and prioritize the goals of the local community, which could be enhanced through the application of ITS technologies. Numerous meetings with key stakeholders and industry participants were held to gain valuable input from the local perspective. An assessment of the Baton Rouge Incident Management Program was performed. Current and projected activities were evaluated and recommendations for future activities were made.

An analysis of the Baton Rouge Congestion Management Plan and the congestion model along with a review of the Financially Constrained 20-year Plan provided insight into the perceived transportation infrastructure deficiencies. This analysis provided the foundation for identifying the primary or priority corridors for ITS implementation.

An investigation into the regional traffic signal system and the Computerized Traffic Signal Improvement Program provided the background for mapping future traffic signal improvements into the proposed regional ITS network.

An equipment inventory and architectural mapping of the existing operational and communication structures which support the City/Parish Emergency Management Agencies was performed. These elements were reviewed for potential inclusion and integration into the Baton Rouge ITS Deployment structure.

1.6.5 Building Upon the National ITS Architecture Framework

The National ITS Architecture provides the framework for developing and deploying ITS technologies and improved management techniques. As part of its format, a common set of definitions, subsystems, data flows, and data flow definitions from which to describe ITS systems and services have been developed with the perspective of a 20-year full ITS deployment.

During the first phase of the Baton Rouge ITS deployment, emphasis is directed at the following four levels:

- Construction of core ITS infrastructure,
- Integration and further development of the existing "Interim" ITS operational systems,
- Integration and program development for the planned ITS elements, and
- Utilization and integration of existing Baton Rouge systems and platforms.

The primary Baton Rouge user service requirements are defined based upon the primary user service bundles associated with supporting local objectives and goals. The Baton Rouge user service requirements were then mapped into the National ITS Architecture's fifty-three (53) market packages.

The mapping process resulted in identification of twenty-three (23) specific Baton Rouge market packages for deployment in the long-term, 20-year, scenario. Further refinement identified "early market packages", which may initially be deployed in the Baton Rouge area. Key factors in relation to the benefit for initially deploying these specific market packages include the following:

- Ability to satisfy fundamental requirements which enable implementation of other, more advanced, packages over time to meet local needs.
- Ability to be implemented with existing technologies and standards and exhibits limited non-technical risk.
- Ability to provide framework for integrating legacy ITS elements.
- Have demonstrated tangible benefits within implementations elsewhere in US.

Market packages are composed of specific equipment packages and set relationships between subsystems. Equipment packages are identified with specific subsystems. All the equipment packages associated with a subsystem may not be assembled within the initial phase or phases of an ITS deployment. The role or character of a subsystem is based upon the actual equipment packages deployed. This role can be designed to develop over time.

The Physical Architecture assigns the logical processes to the physical subsystems and service packages but it is the physical subsystems, which are deployed that actually perform the transportation functions.

1.6.6 Legacy ITS Elements and Existing Baton Rouge Systems

The National ITS Architecture provides a natural framework for integrating local systems and developing a regional architecture. The regional architecture for the Baton Rouge ITS deployment attempts to balance the existing infrastructure and conditions with the proposed ITS infrastructure and planned functionality.

As a preliminary step, the existing and currently programmed systems and platforms within the Baton Rouge area were mapped to the National ITS Architecture blueprint or "Sausage Diagram". This mapped structure identifies the potential for integration of legacy systems to the Baton Rouge ITS deployment as it is implemented over time.

The existing ITS elements, planned ITS elements, and existing Baton Rouge Systems and Platforms are identified in the following:

Baton Rouge Legacy ITS Elements

The inventory of existing and planned ITS elements provide the starting point for ITS deployment in the Baton Rouge area. Independently developed and deployed, these individual elements have the potential for being brought together and developed into an "Interim" ITS Operational System. Currently the existing ITS elements are, at best, loosely interconnected operationally. Their impact and benefit to the public will be improved within the structure being developed for the Baton Rouge ITS deployment.

The Existing ITS Elements and/or related systems include:

- Advanced Traffic Signal Control Systems.
- Traffic Signal Preemption. (triggered locally)
- Motorist Assistance Patrols. (two patrols, limited coverage)
- Vehicle Detection. (limited locations)
- Incident Management Program/Plan. (ongoing development)
- Highway Advisory Radio. (four sites)
- Portable Dynamic Message Signs. (local control, used in construction zone)

The Planned ITS Elements include:

- City/Parish Geographic Information System. (GIS)
- Automated Vehicle Location (AVL) System for Emergency Vehicles.
- Automated Vehicle Location (AVL) System for Motorist Assistance Patrols.
- Automated Vehicle Location (AVL) System for Para-Transit Vehicles.
- Automated Vehicle Location (AVL) System for Fixed-Route Transit Vehicles.
- Electronic Fare-Card Program for Para-Transit Vehicles.
- Electronic Fare-Card Program for Fixed-Route Transit Vehicles.
- Interim Closed Circuit TV Camera Locations. (potentially five locations)

Baton Rouge Legacy Systems and Platforms

The Baton Rouge City/Parish emergency management agencies have developed a comprehensive operational system for the management of local and regional emergencies. These existing inter/intra-agency and agency-public communication and coordination platforms provide an initial interface, which brings together a collection of agencies and systems that will be included in the Baton Rouge architecture definition.

The Existing Baton Rouge Systems and Platforms include:

- Computer Aided Dispatch (CAD) for Emergency Vehicles.
- Community Alert (CAL) Notification System.
- City/Parish 800 Mhz Trunked RF Communication System.
- City/Parish Conventional RF Communication System.
- Riverbend Nuclear Power Plant Emergency Notification System.
- Contel Weather Monitoring System.
- Watershed Monitoring System.
- Marine Communications.
- National Warning System (NAWAS) Hotline.
- Industry Hotline.
- Media Hotline.

1.6.7 Architecture of the Baton Rouge ITS Deployment

Identification of Market Packages was selected as the starting point for defining the Baton Rouge ITS deployment's functional requirements and system specifications. As the deployment is being implemented and as the system matures, it is reasonable that the regional goals and objectives will expand to capture increased functionality from the core ITS infrastructure.

Representation of the Regional Architecture

Based upon the Baton Rouge Strategic ITS Deployment Plan's near-term and mid-term programs, the Baton Rouge High Level ITS Architecture may be represented as illustrated in *Figure 1-1*. This diagram represents the subsystems which will be deployed; existing systems which will be mapped to subsystems; and terminators defined by the National Architecture and that identify the agencies, which will be involved.

The Baton Rouge "Architecture Diagram" represents all potential interfaces to regional agencies and systems so that potential interface requirements are not overlooked in the Baton Rouge architecture definition.

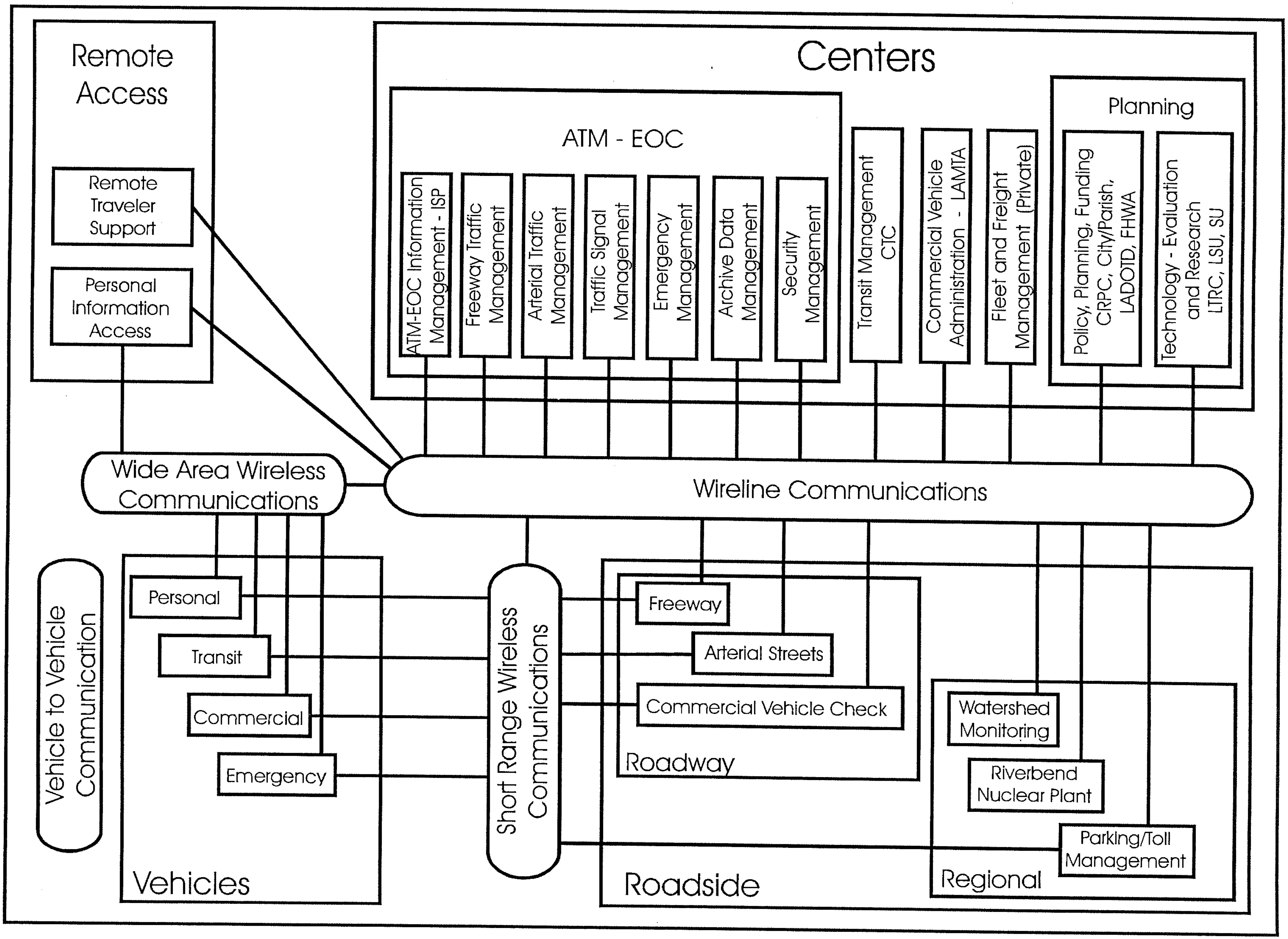


Figure 1.1 Baton Rouge ITS Architecture

Baton Rouge Market Packages

In planning the Baton Rouge deployment those Market Packages which were identified that support the Baton Rouge "ITS Goals and Objectives" were selected. They are identified in *Table 1.4.* Market Packages introduce deployment-oriented ITS building blocks. It is important to note that Market Packages provided a manageable service-oriented approach to establish Baton Rouge's physical architecture definition from the start. In the future more advanced Market Packages will be able to use components established in this early phase of development.

Table 1.4 - Baton Rouge ITS Market Packages

Number	Package *	Market Package Name
1	ATMS-01	Network Surveillance
2	ATMS-03	Surface Street Control
3	ATMS-04	Freeway Control
4	ATMS-06	Traffic Information Dissemination
5	ATMS-07	Regional Traffic Control
6	ATMS-08	Incident Management System
7	ATMS-11	Emissions and Environmental Hazard Sensing
8	ATMS-13	Standard Railroad Grade Crossing
9	EM-1	Emergency Response
10	EM-2	Emergency Routing
11	EM-3	Mayday Support
12	ATIS-1	Broadcast Traveler Information
13	ATIS-2	Interactive Traveler Information
14	APTS-1	Transit Vehicle Tracking
15	APTS-2	Transit Fixed Route Operations
16	APTS-3	Demand Response Transit Operations
17	APTS-4	Transit Passenger and Fare Management
18	CVO-03	Electronic Clearance
19	CVO-04	CV Administrative Process
20	CVO-06	Weigh-in Motion
21	CVO-07	Roadside CVO Safety
22	CVO-10	HAZMAT Management
23	ITS1	ITS Planning

* Note: The market packages are separated into the following seven separate categories:

ATMS - Advanced Traffic Management Systems
EM - Emergency Management Systems
ATIS - Advanced Traveler Information Systems
APTS - Advanced Public Transit Systems
CVO - Commercial Vehicle Operation Systems
ITS - Intelligent Transportation Systems Planning
AVSS - Advanced Vehicle Safety Systems

The Market Packages selected for deployment identify specific elements of the National ITS Architecture, which will become elements of the regional architecture. Many of the existing Baton Rouge transportation and emergency management systems, terminators, and system interfaces are equated with systems and interfaces identified in the National Architecture. In this manner, the Baton Rouge architecture is based upon the framework of the National ITS Architecture, but it is modified to account for local systems, services, and structures.

Diagrams identifying subsystems, equipment packages, and architecture flows associated with each specific market package selected for deployment within the Baton Rouge architecture definition are represented in *Section 6.9 of the ITS Early Deployment Study.*

Baton Rouge Subsystems, Equipment Packages and P-Specs

The Baton Rouge architecture definition is based upon a near, mid and long-term deployment program. These programs identify the component items and descriptions, the associated equipment packages and the subsystem elements, which will be supporting the programmed deployment. Refer to *Section 9 of the ITS Early Deployment Study* for the complete near, mid and long-term deployment programs which represent the Baton Rouge Architecture definition.

As depicted in the Baton Rouge "Architecture Diagram" the subsystems associated with the ITS Deployment Program, the legacy and planned ITS elements and all legacy Baton Rouge City/Parish systems are mapped together to define the Physical Architecture of the Baton Rouge ITS deployment. Recommendations for the Baton Rouge ITS plan builds itself upon the principles set forth by FHWA for deploying a "core infrastructure" in a metropolitan area. As stated by FHWA, "Establishment of the core infrastructure features permits optimal operations and management of roadway and transit resources through use of currently-available technologies and strengthened institutional ties."

The core infrastructure is defined as consisting of seven features which include the following:

1. Regional Multimodal Information Center
2. Traffic Signal Control System(s)
3. Freeway Management System(s)
4. Transit Management System(s)
5. Incident Management Program
6. Electronic Fare Payment System(s)
7. Electronic Toll Collection Systems(s)

The physical architecture that has been recommended supports the integration and development of the first six features of the core infrastructure. The lack of toll facilities within the Baton Rouge area negates consideration of the seventh feature. Legacy and planned systems and elements provide an important base for incorporation into the Baton Rouge ITS definition.

The logical architecture definition is defined at two levels. The first level is associated with the logical architecture and operations of existing systems and elements. The performance specifications and data flows associated with these systems and elements may or may not meet the standards requirements of the National Architecture.

The second level of the Baton Rouge logical architecture is defined by the performance specifications (p-specs) supported by the equipment packages required for deployment of specific Market Packages as defined in *Section 6.9 of the ITS Early Deployment Study.* The final data dictionary and data flow definitions associated with these p-specs will be developed during the design and integration phases of the Baton Rouge deployment.

1.6.8 Consistency and Standards Requirements

As identified earlier, the Transportation Equity Act for the 21st Century (TEA-21) requires, as stated in TEA-21 Section 5206(e), that Intelligent Transportation Systems (ITS) projects conform to the National ITS Architecture and standards if they are financed using funds from the Highway Trust Fund (Including Mass Transit Accounts associated with this fund).

Provisions are currently in place, at the federal level, for the development of guidelines to ensure conformance with the National Architecture and standards. These guidelines are a precursor to any policy and standard for regulating and ensuring conformity. Provisions are also in place for the development of a structured approach and representative partnering of federal, state, regional, and local transportation officials and consultants to oversee the deployment of ITS programs. The oversight committee is referred to as a Consistency Assessment Team or COAT. It is recommended that consideration be given to the development of a Consistency Assessment Team for the Baton Rouge ITS deployment.

As much as it is possible, the approach used for developing the Baton Rouge ITS Architecture definition paralleled the recommendations made by the National ITS Architecture document. In anticipation of potential legislative requirements related to consistency the Baton Rouge ITS Architecture definition is based heavily upon the National ITS document.

1.7 Integration with Other Functions

The integration of the Traffic Management Center with other systems and operations within the Baton Rouge TMA is an important consideration. The proposed area wide ITS architecture and the concept for the Advanced Traffic Management and Emergency Operations Center (ATM-EOC) promote the concept of integration with existing systems. The ATM-EOC will house Fire, Police and EMS dispatch; Office of Emergency Preparedness; the U.S. Coast Guard; and the Traffic Management Center (TMC). Once complete, this facility will be one of the first to jointly locate emergency and transportation management functions in an effort to provide integrated management and operations of the regional transportation system. One of the key components of the ATM-EOC will be the central control room. This room will be the center of command and control during incidents and emergencies and would be occupied with personnel from all participating agencies. Agencies, in addition to the ones listed above, which will have a command workstation in the Traffic Management Center control room include the State Police, Capital Transportation Corporation (CTC), LDOTD, and FHWA. The central control room provides all participating agencies with access to video images via video projection devices located in the control room. This also provides the opportunity for real time emergency coordination and management from the ATM-EOC facility.

All agencies to be located at the ATM-EOC will be linked via an internal Local Area Network (LAN) or Ethernet Platform. This in combination with the central control room concept will allow for the complete exchange of data and sharing of data between the traffic control function and all other agencies located at the ATM-EOC. For more details relative to the ATM-EOC, refer to *Section 1.10.*

The ongoing Motorist Assistance Patrols (MAP) and Roadway Incident Management patrols (RIM) will be integrated into and coordinated with the Traffic Management Center operations. Communications between the MAP and RIM patrols with traffic controller personnel to be located at the (TMC) will be established utilizing radio frequency (RF) communications and/or wireless cellular/digital service. The combination of a GPS tracking system and communications with patrol vehicles will allow for real time communication and data exchange relative to roadway and incident conditions.

While CTC will operate their advanced vehicle tracking system for fleet management from the CTC Transit Management Center on Florida Boulevard., they will have full access to real time traffic, roadway and incident data at both their command workstation at the TMC, as well as at the CTC Transit Management Center on Florida Boulevard, via a leased wireline communications connection between the two management centers.

CRPC will also require access to data available at the TMC. CRPC will process current and historic traffic data including traffic volume data, travel speed data, number of incidents and locations, and accident response and clearance data for the transportation network including freeways and arterial streets. CRPC will utilize this data to evaluate existing system performance, plan for future ITS applications, and evaluate the effectiveness of ITS applications and systems previously implemented.

1.8 System Components

System components/equipment to be located within the TMC is defined in *Section 1.10, "Advanced Traffic Management and Emergency Operations Center"*. The following is a listing of primary system components needed to perform system functions within the Roadside subsystems as defined in the Baton Rouge ITS Area Wide Architecture and the ITS Strategic Deployment Plan.

Primary components/equipment required within the Roadside Subsystems for freeway and incident management include the following:

- CCTV cameras and controllers
- Traffic detection devices and controllers
- Fixed location dynamic message signs and controllers
- Ramp meters and controllers
- Highway advisory radio transmission stations
- Communication hub site equipment
- Required power distribution system including transformers, cabling, junction boxes, and cabinet
-

Primary components/equipment required within the roadside system for surface arterials include the following:

- Cabinet and traffic controllers
- Traffic detection devices
- Communications Equipment

Detailed specifications for system components will be developed consistent with the National ITS Architecture Standards where necessary and will be developed in the preliminary and final design phase.

1.9 Communication Subsystem Design Approach

1.9.1 Interim Phase Communications

As discussed in the ITS Early Deployment Plan, the "Interim Deployment Plan" is comprised primarily of integrating existing ITS systems and related elements into the ATM-EOC operations. Remote communications with some of these systems already exist and will be transferred and integrated into the ATM-EOC operations. Most existing and planned telecommunication services for "Interim Phase" elements will be through a leased service.

There is one ITS element which is planned for deployment in the "Interim Plan" which is not an existing ITS system, the planned implementation of CCTV cameras at a few select major interchanges and/or intersections within the region. Both leased service and microwave transmission are being considered for video transmission from these cameras.

The following is a description of "Interim Phase" items and the existing and planned telecommunications media.

Table 1.5 - Proposed Telecommunications Media for Interim Phase Components

ITEM	EXISTING COMMUNICATIONS FORMAT	PLANNED INTERIM PHASE COMMUNICATIONS FORMAT	LEASED SERVICE	COMMENTS
1. Highway Advisory Radio (HAR)	Cellular	Cellular	Yes	Promotional service provided by Cellular One free of charge
2. Vehicle Detection Stations	Public Switch Telephone Service (DSO Type)	Public Switch Telephone Service (DSO Type)	Yes	
3. Portable Dynamic Message Signs (DMS)	None	CDPD	Yes	Portable DMS to be equipped as required
4. Signalized Intersections (Master to TMC)	Public Switch Telephone Service (DS1 Type) Microwave	Public Switch Telephone Service (DS1 Type) Microwave	Yes	Continue existing service with redundant access from TMC
5. MAP & RIM Patrols	RF	RF	No	RF Communications City/Parish System
6. CCTV Cameras	Not installed	Public Switch Telephone Service (Dedicated T1 Circuit) or Microwave Transmission	Possible	
7. Automated Vehicle Location System (EM Vehicles)	RF	RF	No	

1.9.2 Near and Mid Term Communications Subsystem Evaluation

While communication requirements for the "Interim Phase" have basically been established, additional analysis was performed to further develop the communications design approach for the near, mid and long term.

As previously noted, communication is the backbone of any Advanced Traffic Management System (ATMS). Communication requirements are a substantial expense in the cost of deploying an ITS program. The structure of the regional ITS communication distribution can involve any number of configurations. Advances in technology, equipment, and communication accessibility has dynamically changed the options available. System specific evaluations are necessary and full system optimization involves the balance of cost verses performance. This section builds on the conceptual communication analysis in the Early Deployment Study and provides further analysis and evaluation of the options and the cost/benefits of identified alternatives for the Baton Rouge ITS Deployment.

Industry Experiences

Until recently, ITS deployments have involved building a communication system for the ATMS. The trend of building a dedicated ITS communication network has changed. This decision should be determined on a case by case basis.

Some states and municipalities have found that entering public-private partnerships for resource sharing, such as bartering freeway right-of-ways for communication fibers, providing the mechanism for establishing their communication requirements.

Other states and municipalities have found that a lease-build option, or 'hybrid' solution, for meeting communication requirements can significantly reduce the cost associated with deploying the near to mid term ITS programs.

Detailed break-even analysis of the Maryland 'CHART' Program, identified that their break-even point is as far out as 20 to 40 years. However, it is necessary to keep in mind the design parameters associated with the 'CHART' Program. An equivalent 'CHART' design environment in Louisiana would involve deploying continuous communications between Baton Rouge, New Orleans and Lafayette, as a minimum. The Baton Rouge ITS deployment involves a densely distributed network of communication requirements necessary to connect local freeways and major arterials to the Traffic Management Center (TMC).

Applicable Communication Considerations

There are various options for interconnecting Traffic Management or ITS Centers with the field components and/or other centers. These include, but are not limited to the following:

- Dedicated Lines
- Leased Lines
- Micro-wave
- Radio
- Cellular Radio (Cellular Telephone)

<u>Dedicated Lines</u>

A privately owned, dedicated line, communications network requires that the owner posses the right-of-way for every link in the network. The lack of right-of-way narrows the choices in most communication decisions for private companies. Availability of the right-of-way is an asset to the City/Parish Government and LDOTD, but makes communication technology decisions more complex.

Video surveillance for incident management presumes the use of fiber optics for the long haul (Trunk) and for the cameras in the arterial network. Fiber optic technology surpasses both coaxial cable and most twisted-pair links as the technology of choice for both public and private networks. Decisions related to video picture quality is one issue. The controlling issue is the communication bandwidth requirement for transmitting the combined data of all the cameras from the HUB or concentration point to the TMC.

Dedicated lines can be either copper-pair or fiber optic cable. The cost related to fiber cable and the equipment is now a small factor in the decision. The labor/conduit costs of installation are now by far the largest cost elements in building the communication network. Advances in communication technology provide the potential for future high bandwidth video transmission over copper wire; however, this is not commercially available today. Again the labor/conduit costs remain the largest cost elements in installation, field functionality being the same.

Leased Lines

The most common form of private communications is leased lines. This service is contracted from a communications common carrier. The capital cost to install a large communications system is borne by many users through monthly fees. There is usually an initial installation cost associated with establishing a service. Available leased lines include voice grade, data grade analog (1200-6900 baud modem), digital (56 Kbps) and T-1 or high capacity digital (1.544 Mbps). There are higher speed lines available, and in the near future BellSouth will offer Fractional T-1 with speeds between 56 Kbps and 1.544 Mbps. There are alternative carriers, which lease service available on their fiber optic cable plant or network.

Leased lines provide a reliable communications solution because of the carrier's grid redundancy and the coverage of the carrier's network. BellSouth covers the Baton Rouge region with a grid redundancy that provides many paths from one location to another. The lease of a public/private network service provides robustness and rerouting of the signal if one segment of the system fails. BellSouth has in-house personnel and equipment statewide which can be brought in for repairs. Privately owned networks contract this service to a local agent, which is of a limited resource in the Baton Rouge area.

Microwave

Line-of-sight microwave has been used for years to transmit voice data and video by public and private networks. Microwave technology requires a microwave dish at each end of communication pair. For example, thirty-three field locations would require sixty-six microwave dishes, one at each end. This is not reasonable for the fully distributed communication network that Baton Rouge will require. There are potential frequencies available which would have to be evaluated on a needs basis and FCC licenses applied for.

Radio

The short range radio industry has experienced much development in the past few years. It is driven by new competitiveness in communications and new information distribution needs of industry in general. These advances make low-power radios a practical solution to data distribution because they are relatively economical, re-use frequencies, and do not require costly and time consuming FCC licensing for each circuit. The number of radios in a system would be limited to the number of frequencies available, this is not a viable solution for large distribution system.

Radio systems must also have techniques for insuring non-interference with existing radio networks. One of the most advanced of these newer technologies is Spread Spectrum Radio, a technique developed for the military in which radio signals are spread over a wide frequency band at lower power. Only radios with the "spread code" can receive the signal. This allows frequency re-use and low power output so that there can be many radios in a system without interference. Several manufacturers now produce spread spectrum radios for applications in the general communicators market. This technology is capable of carrying compressed (112 Kbps) video. The continued development of local area network functionally with these devices would make them suitable for local distribution systems to be incorporated into the overall network.

Infrared

The use of the Infrared spectrum for data communications is largely limited to indoor extensions, or substitutions for Local Area Networks (LAN) wiring. Infrared technology is only slightly less subject to the same limitations as visible light; that is, it cannot penetrate solids, fog, or heavy dust. The largest application of this technology is for TV and VCR remote control and it is generally suited for those applications with limited environmental requirements. Infrared technology is not suitable for general use in the Baton Rouge ITS deployment considering the communications requirements.

Cellular Radio

Cellular radio is a technique for frequency re-use in a large radio communications system. Its largest implementation, by far, is in mobile telephone networks. Cellular radio gets its name from the fact that an area is divided into cells which are 2 to 20 square miles in size. At the center of each cell is a control radio, which handles the network management functions. A radio requests a frequency over a control channel and one is assigned. The cellular layout permits frequencies to be re-used in non-adjacent cells. Due to the demand for car telephones, a new, second generation of cellular systems has emerged, characterized by digital, higher-speed transmission and enhanced network control. These new systems provide greater bandwidth, capacity and frequency re-use capability.

Cellular radio techniques for data systems are being developed and expanded. However, new networks will likely have the same or similar high-rate structure, which makes them uneconomic for constant connections and high use circuits. Cellular phone usage costs are expensive and are based upon the amount of communication time. Therefore, use of cellular radio for the ITS program will likely be limited to specialized niche applications and needs.

Communications Requirements

The communication requirements associated with the Baton Rouge ITS deployment are based upon four separate but related platforms. These include, but are not limited to the following:

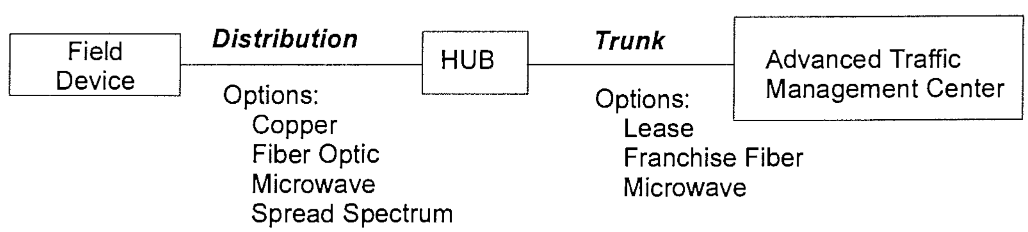
- Communication between Freeway ITS devices and the HUB point
- Communication between Arterial Traffic/ITS devices and the HUB point
- Communication from the HUB points, or communication concentration locations and the TMC
- Communication between the TMC and all other required City/Parish or State agencies

The field devices associated with deployment along the freeway and on the arterial streets are referred to as slave devices. The local interconnection of these devices to a HUB is referred to as communication distribution, supported by a local distribution network. The command and control equipment located at the TMC is referred to as master devices associated with operation of the Advanced Traffic Management System. The regional interconnection of the HUBs to the TMC is referred to as the long-haul communication link, supported by a Trunk distribution network.

The concepts and options for building the communications network and/or leasing the communications is illustrated by the following diagram.

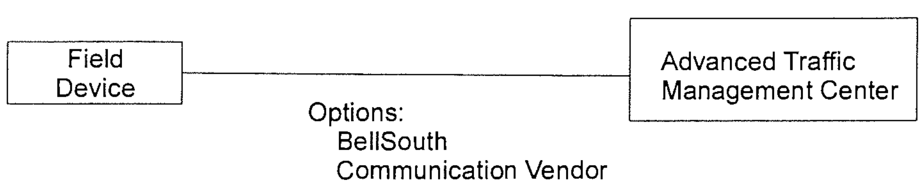
Communication Concepts

Concept 1: BUILD



Concept 2: LEASE

Lease from Field Cabinets to the Traffic Management Center



Also, it should be noted that not all of the field devices will be distributed to and from a HUB location. There are several isolated devices, especially Dynamic Message Signs (DMS), which lie beyond the proposed physical limits of the of Baton Rouge ITS infrastructure. Communication with these devices will involve a direct link to the TMC.

NOTE: For comparative purposes the Baton Rouge ITS Near Term Deployment Conceptual Plan will be used for representative communication requirements of the Baton Rouge ITS program. The Near Term Deployment will tentatively involve the deployment of, as a minimum, the following field devices:

14 Dynamic Message Signs (10 isolated, 4 in the full coverage area)
24 Closed Circuit Televisions (5 isolated, 19 in the full coverage area)
30+ Vehicle Detection Stations (approximately)
2 Ramp Metering Locations
8 Vehicle Classification Stations (maximum)
Total - approximately 50 field cabinets.

Communication With Field Devices

Field devices identified within the Baton Rouge ITS deployment include, but are not limited to the following:

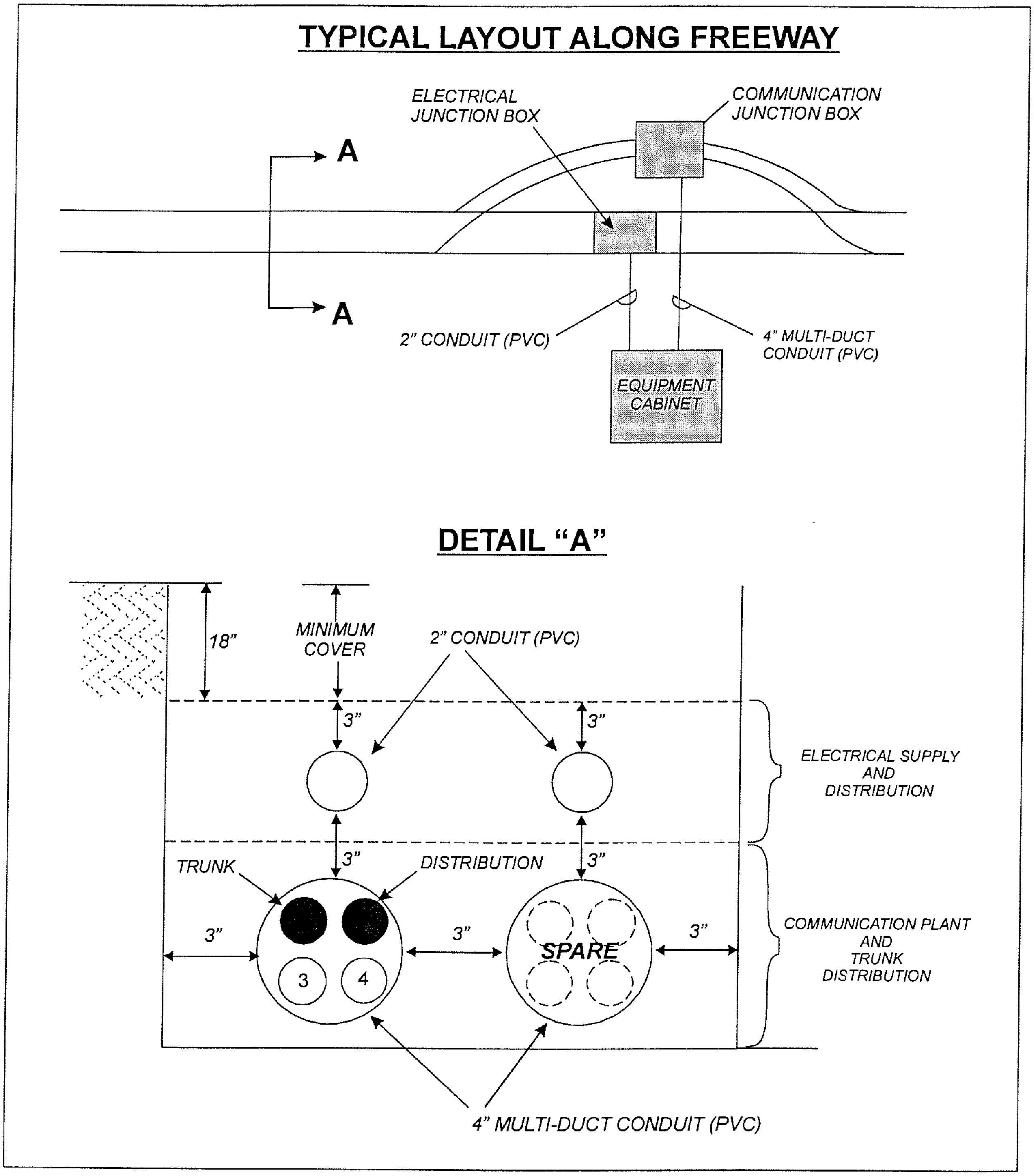
Freeway -

- Dynamic Message Signs
- Video Cameras
- Vehicle Detectors
- Vehicle Classification Stations
- Roadway/Weather Sensors
- Ramp Meters
- Highway Advisory Radio

Arterial -

- Dynamic Message Signs
- Video Cameras
- Traffic Signals

These field devices or their controllers will be housed within a field cabinet, which requires electrical power as well as communication to support field data, video (at camera locations) and voice. As stated, all field cabinets will require electrical power. Typical industry design for the provision of power to ITS field devices involves the design of a power distribution plant. A typical design configuration is presented in the following diagram.



Distribution of the power plant within the field provides the opportunity to effect the installation of a communication plant for the cost of the conduit, communication media and minimal labor. The labor/trenching costs are a burden of the system's power requirements, regardless of the decision to deploy a communication plant. Review of the diagram illustrates the co-location of the power plant with the communication plant.

Communication associated with the video cameras will require the greatest amount of bandwidth. Bandwidth requirements for communication with each of the other field devices can be accommodated over a standard ISDN circuit. Analog video supporting broadcast quality, full-motion video at 30 frames per second, requires the most bandwidth. Alternative communication technologies have been used to transmit compressed digitized video in other Traffic Management System applications. Maryland DOT utilizes a 1/4 T1 video compression algorithm (384 Kbps) to transmit images from up to four cameras by multiplexing their signal over a single Asymmetric Digital Subscriber Line (ADSL). In order to also provide camera control and vehicle detection at the same location, the maximum number of cameras that can be supported at this low-end video compression quality is three or less. In addition to the cost of the ADSL service (per month) is the cost/lease of the video compression/decompression (CODEC) equipment at each end of the communication link. Costs for a CODEC range from $4,000 - $8,000 a piece or more.

Field Cabinet Communication Alternatives

There are several alternatives available to provide individual communication service to each individual cabinet location. Each of these communication links can either be a long-haul link back to the Traffic Management Center or a distributed link from the cabinet location to a HUB or concentration point. Potential alternatives include the following:

- Public-Private Partnership
- Microwave
- Spread Spectrum
- Copper line
- Fiber Optic
- Leased Service
- Use of the City/Parish Franchise Fiber

Preliminary evaluation identifies the advantages and disadvantages of each of these alternatives and helps to eliminate those not suitable for the ultimate Baton Rouge ITS design.

<u>Public-Private Partnership</u>

A Public-Private Partnership for the acquisition of a communication plant involves allowing a third party access to the 'right-of-way' along the freeways in the Baton Rouge area. Federal Highway Administration (FHWA) workshops related to 'Communication for ITS Deployment' have identified that it can take up to two years to finally establish a *Parent Tenant* agreement for this Public-Private relationship. This arrangement creates an environment that permits non-LDOTD personnel to be allowed access to perform system maintenance work within the state freeway system. Because of the time necessary to establish such a relationship and the potential liability to the State of Louisiana, it has been decided that this option will not be pursued by the State of Louisiana for the near term deployment scenario. Options for establishing this relationship may be re-addressed for the mid to long term deployment.

<u>Microwave</u>

Microwave communication requires a microwave dish at each end of the communication pair. Microwave communication also requires FCC licensing for each individual communication link.

The fully deployed Baton Rouge ITS network would require in excess of 100 - 200 microwave pairs. If the links are to be a long-haul configuration then there would need to be 50 - 100 microwave dishes at the Traffic Management Center. The center will be located near the Metro Ryan Airport and has FAA restrictions related to RF communication in that area. Use of an exclusive microwave-based communication system will also require tower construction and/or device placement. These reasons eliminate microwave as the ultimate communication link to individual cabinet locations. Microwave should be reviewed for use as the communication media for interim equipment deployment and for remote equipment locations on a case by case basis.

Spread Spectrum

Spread Spectrum technology has a limited range of effectiveness of approximately one mile. The distance from the Traffic Management Center to the I-10/I-110 split is in excess of seven miles. Spread Spectrum is not an option for the long-haul communication configuration. This technology is an option for isolated applications such as providing communication to cameras and detectors on the Mississippi River Bridge. The data would then be transferred back to the TMC over the landline communication network deployed for the system.

Copper Line

Copper line communications can be deployed or leased. The limitation or practical limits on a 24-gauge twisted pair DS1 line, in one direction, is approximately 18,000 feet. This distance limitation places requirements for amplifying the signal several times to effect a long-haul communication configuration, if a copper plant is to be deployed. The bulk of the cost for deploying the copper plant involves the labor/conduit for installing the physical super-structure. The marginal cost difference for installing fiber optic cable instead of copper is insignificant relative to the increase in communication bandwidth. It is recommended that fiber optic cable be installed during any 'build' communication plant deployment.

Copper line communications can be leased from any of the Baton Rouge area's communication vendors, including BellSouth. Copper line will not provide the communications bandwidth requirements necessary to support full motion video, however, it will support compressed, digitized video. Representative estimated installation costs and monthly costs/fees associated with leasing the communication service requirements for the projected near term scenario have been identified. Full system deployment costs, both initial installation costs and monthly/annualized costs/fees, will be much higher than those established for the near term deployment. With respect to a twenty-year life cycle cost, the installation costs are insignificant estimates. Estimated costs for leasing the near-term deployment scenario are identified in *Table 1.6*.

Table 1.6 Preliminary Estimate of Near Term Deployment Lease Alternative Costs

Type of Service	Services Required	Installation Cost	Installation Total	Monthly Fees	Annualized Fee	CODEC costs/fees	Redundant Fiber Ring fees
ISDN	36	$250 *	$9,000	$100 *	$43,200	Extra	Extra
ADSL	14	$350 *	$4,900	$125 *	$21,000	Extra	Extra
		Total	$13,900		$64,000	unknown	unknown

Total with Redundant Fiber Ring Fees $76,000 - $100,000 (potential min.)

Costs identified are representative of current Baton Rouge industry standards and are approximate.
Note: These costs do not reflect the costs (initial and monthly) for integration of the arterial field devices.

The installation costs identified do not include the conduit and installation from the cabinet to the service connection, nor to the individual field device. The CODEC's are not identified as being included within the monthly fees or as an initial lump sum equipment cost. Redundant fiber ring fees identified as an extra cost could add an additional $12,000 to $36,000 to the annualized cost, as a minimum. Monthly fees identified are based upon current industry quotes and are subject to change over time. The histories of 'communication monthly fees' associated with other ATMS projects have witnessed some instances where significant increases have been implemented from the initial negotiated fee. Considering these estimated annual lease costs, plus significant additional costs associated with related equipment (CODEC's) and the installation of communication conduit and cabling from the field cabinets to both the field devices and the service connection, a leased system for the distribution component appears unreasonable.

Fiber Optic

Fiber Optic line communications can be deployed within the interstate system, but existing leased fiber optic service cannot be practically provided to each cabinet because of the limited system coverage of fiber optic plants within the region. However, use of a build fiber optic plant is reasonable for the distribution system between the individual field devices and the HUB, based on the fact previously described that a power distribution plant will be necessary and will provide the opportunity to affect the installation of a communications plant for the cost of the conduit, communication media and minimal labor.

The practical limits of a single mode fiber are dependent upon the number of times it is spliced and varies depending upon the operational scenario. Within a long-haul communication application a signal generated by a Frequency Division Mutiplexor can carry a signal for approximately 25 miles over 'single-mode fiber optic cable. This distance limitation will not constrain the design environment of the Baton Rouge ITS deployment for effecting a long-haul communication configuration. Long-haul communications will be established between the TMC and the proposed field HUB locations. All of the proposed HUBs are within a 25 mile distance from the proposed center location. As identified in the 'Copper Line' section, the bulk of the cost for deploying the fiber optic plant involves the labor/conduit for installing the physical super-structure. This physical super-structure cost is the same regardless if copper line or fiber optic cable is installed.

Leased service over a vendor's fiber optic cable is based upon the amount of data sent over the fiber. As an industry standard, the individual fiber optic cables are not leased; bandwidth is leased. The video data or video images will be generating the greatest amount of data transfer requirements. This data stream must be available 24 hours a day, 7 days a week, for each camera deployed. Analogous to a watershed distribution system, a distribution communication plant would bring the individual data streams from the individual cabinets to a concentration point or HUB. These data streams would all be combined and transferred to the TMC over the vendor's long-haul fiber optic plant, much like creeks and tributaries combining to feed the flow of a river to the Gulf. In essence, the use of a leased redundant fiber ring from the HUB facility to the TMC is a viable consideration; however, the use of the City/Parish franchise fiber network must also be considered.

Leased Service

Issues related to leased service options have been addressed in the 'Copper Line' and 'Fiber Optic' sections.

Use of the City/Parish Franchise Fiber

The Baton Rouge City/Parish Department of Public Works has established franchise agreements with two separate fiber optic vendors. These agreements have resulted in the acquisition of four (4) dark fibers for the City/Parish within both of these vendors' fiber optic plants. There are certain restrictions for use of these dark fibers. Communication over these fibers is not inherent to the possession of the fibers. The vendors do not provide the City/Parish use of their communication system, switching center and equipment. If these fibers will be used by the City/Parish, it is necessary to either create an operating communication system that will make use of the City/Parish's fiber optic network or lease this service from the vendors. Communication service costs to the City/Parish, as stated by the fiber optic vendors, will be the same as if the City/Parish did not have possession of these four dark fibers. There is a requirement of a five-year minimum contract relationship. There will also be an initial installation cost along with a monthly lease cost.

The physical layout and location of the two fiber optic networks within the Baton Rouge area is significant. As a representation of their coverage it is noted that one of the systems includes both an initial build out of twenty-eight (28) miles of fiber optic infrastructure and a second expansion of thirty-two (32) additional miles of fiber optic infrastructure. All major arterials within the Baton Rouge area are covered by these two fiber optic networks. In many cases these corridors are covered by both fiber optic plants. Those areas, which have dual coverage, provide the City/Parish with a total of eight (8) dark fibers along that route.

Both fiber optic vendors have indicated that unless the City/Parish leases service through their switching center and allows the vendor's communication devices to provide point-to-point connection then the City/Parish system will not be supported by the vendor's Network Management System (NMS). In order to access the physical dark fibers from any point within the network there are connection charges as detailed in *Table 1.7*:

Table 1.7 Franchise Fiber Plant, Connection Costs

		Existing Splice Enclosure	New Splice Enclosure
Set-up Fee	per set-up	$150.00	$150.00
Fiber Splice Cost per Splice	$45.00		
Splices per connection	8		
Total Splice Cost	$360.00	$360.00	$360.00
Enclosure Cost		NA	$500.00
Cost Per Connection	**TOTAL**	**$510.00**	**$1,010.00**

The two fiber optic plants cross the Baton Rouge area freeways no less than seventeen times. This proximity allows them to be connected to the communication network deployed along the freeways. Consideration should be taken to utilize these franchise fibers to support the ITS communication requirements until the full ITS program is deployed. As the ITS communication system is developed those devices installed within the City/Parish arterial network can be connected to the Traffic Management Center over the franchise fibers. This arrangement is equivalent to a Public-Private Partnership. The difference between the Baton Rouge scenario and other Public-Private Partnership scenarios is the fact that the right-of-way is property of the City/Parish instead of the state. Normally the state DOT establishes the relationship.

Near and Mid Term Communications Plant

The near and mid term deployments of the Baton Rouge ITS Program will involve providing full coverage of I-10 from the I-10 Mississippi River Bridge to Seigen Lane, I-12 from the split to O'Neal Lane and I-110. Full coverage includes full video coverage as well as full vehicle detection along all freeway main lines and exit ramps. In addition it will include both Dynamic Message Signs (DMS) within the full coverage area as well as several remote DMS. An in-depth evaluation of the alternatives for the ultimate communication system to support the Baton Rouge ITS deployment is provided in Appendix C. The Appendix C report identifies the proposed long term or ultimate communications system concept design for the Baton Rouge ITS Project with associated costs.

The alternative evaluation in Appendix C as well as the information previously documented in this section indicates that a hybrid type communication system may be the most effective for the planned ITS deployment in the Baton Rouge TMA for the near and mid term deployment scenarios. The hybrid system would consist of a combination of "build" and use of a public private partnership (use of the franchise fiber network).

The build component would be associated with the distribution system between the field devices and the HUBs. As previously noted, a power distribution plant will be required to service the field equipment deployed within the interstate R.O.W. The labor and trenching costs are a burden of the system's power requirements, regardless of the decision to deploy a communication plant. By utilizing a common trench for power and communications, the effective cost of installing the communications plant is significantly reduced only requiring conduit, communication media and minimal labor. Also, due to the insignificance of the cost differential between copper and fiber optics relative to the increase in communication bandwidth, fiber optic cable is recommended for any "build" communication plan deployment.

The near and mid term deployment will require that HUBs 1, 2, 3 and 4 be established for communication distribution within the influence range of these HUBs. The proximity of the two franchise fiber plants to these HUB locations and to the TMC will provide an interim solution for the long-haul communication requirements. Until the full-system build out is complete the franchise fibers will provide a low cost, non-lease alternative for providing the trunk communications from the HUB's to the TMC. In addition, those traffic signals identified for upgrade, or those that have already been upgraded, within the City/Parish's Computerized Traffic Signal Improvement Program may be connected to the system over the franchise fiber network. For a one time connection fee each of the Traffic Signal controllers may be connected to the Baton Rouge ITS network. The ITS communication system will provide the mechanism for making the City/Parish franchise fibers operational. The ITS communication system will also provide the Network Management System for maintaining this communication network.

It is recommended that the communication design of the near and mid term ITS Program include the development for utilizing the City/Parish franchise fibers for long-haul communications between the HUB sites and the TMC, and for interconnection of improved traffic signal locations.

1.9.3 Ultimate Communications Plant

A top-level description for three communication design alternatives has been prepared. This report is provided in the Appendix C. The design criteria for these systems is based primarily on achieving an optimum utilization of the network resources (video, voice and data) and the ability to share those resources among various agencies requiring access to them. A network architecture was selected which is inherently designed for survivability and equipment selections that provide redundancy to ensure a high degree of network availability under fault conditions. Network management to reduce potential system outages and lower maintenance costs over the life of the system is included in each of the designs. Each of the designs incorporates two basic fiber schemes, 1) ring networks, and 2) point-to-point circuits, which are combined to provide a robust and flexible communication system. Configuration and integration of the City/Parish franchise fibers was not addressed in extensive detail. These franchise fibers will ultimately be connected to the ITS communication system through a drop and insert configuration. In this fashion their integration will be no different than adding an additional device cabinet within the communication ring network.

The costs identified within the three designs are based upon a full build out scenario with an expanded coverage area assuming 144 camera locations. The near term deployment will require only 24 cameras along the freeway. Demand for camera coverage along the Baton Rouge arterial network will dictate the ultimate number of cameras to be deployed. It is realistic to assume a total number of cameras for freeway coverage to be in the neighborhood of 70 – 80 cameras. Therefore, the costs identified within the report are realized to be at the higher end of the range for communication costs.

Review of the communication report will identify many of the questions which may arise concerning benefits and options. The report does not identify incidental benefits which may be realized from the deployment of an ITS communication system. This system will provide the Baton Rouge City/Parish with a redundant, geographically diverse path routed communication network with a high degree of protection. This network can ultimately be used to support or replace other City/Parish communication requirements related to the Advanced Traffic Management Center and Emergency Operation Center.

1.10 Advanced Traffic Management and Emergency Operations Center (ATM-EOC)

The ATM-EOC will be the center of operations and communications for Emergency Management and the Baton Rouge Advanced Traffic Management System. The previous section (*Section 1.5),* included a discussion relative to hours of operation and operating philosophy for the TMC. This section will focus on the physical elements of the TMC including the central control room, equipment and system requirements, communications, and the facility layout. As noted, the ATM-EOC will house Fire, Police and EMS dispatch; Office of Emergency Preparedness (OEP); and the TMC. Once complete, this facility will set precedence in the United States as the first traffic management center which jointly locates this diversity of agencies and talents for the development, integrated management and operation of a transportation system.

This concept for deploying an Advanced Traffic Management System will bring the emergency management agencies, local traffic operations capabilities, and the TMC operations personnel together into one facility. This facility will provide improvements to the management of both freeway and arterial traffic while creating an environment for complete access to all resources/information by all the participating agencies.

One of the primary features of the ATM-EOC is the central control room. This room will be the center of command and control during emergency events and will be occupied with personnel from all participating agencies. This room will house numerous consoles and video projection devices for emergency coordination and management. Based upon surveys of and discussions with the management level personnel for each of the participating agencies, minimum and long term projected control room requirements have been estimated. Requirements for including 'other agency' participation in the development of this center have also been considered. The expected number and type of central control room console requirements are identified in *Table 1.8*. Those consoles and work areas which are anticipated to be operational when the ATM-EOC opens are identified in the column 'ATM-EOC Control Room'. The expected increase over time for console positions is identified in the column 'Future'. The fully equipped concept for operations at the ATM-EOC in the future is identified in the column 'Total'.

Table 1.8 - Control Room Console Positions and Work Areas

	TYPE	Current	ATM-EOC Control Room	FUTURE	TOTAL
All Supervisor Work Station	Command Console	1	1	0	1
Baton Rouge Police Department	Shift Supervisor	1	1	0	1
	Radio Dispatch	4	4	1	5
	Complaint Taker	4	5	2	7
	Common Equipment Area	1	1	0	1
State Police	Command Workstation	0	1	0	1
C/P Sheriff	Command Workstation	0	1	0	1
EMS/911	Shift Supervisor	1	1	0	1
	Radio Dispatch	2	2	1	3
	Complaint Taker	4	5	1	6
	Common Equipment Area	2	2	0	2
	Operations Chief Area **	1	0	0	0
	Community Alert System	1	1	0	1*
	System Watch	1	1	0	1*
	Dictaphone Workstation	1	1	0	1*
Baton Rouge Fire Department	Shift Supervisor	1	1	0	1
	Radio/Complaint Taker	2	3	1	4
	Common Equipment	1	1	0	1
Volunteer FD	Radio/Complaint Taker	1	1	1	2
TCC Group	Freeway/Arterial Management	NA	1	2	3
	Incident Management	NA	1	0	1
	Motorist Assistance	NA	1	0	1
	Common Equipment Area	NA	1	0	1
FHWA	Command Console	NA	0	1	1
LADOTD	Command Console	NA	0	1	1
C/P DPW Maintenance	Command Console	NA	1	0	1
CTC Transit	Command Console	NA	1	1	2

TOTAL	31 consoles	43 consoles
	5 common equipment areas	5 common equipment areas
	3* System areas	3* System areas

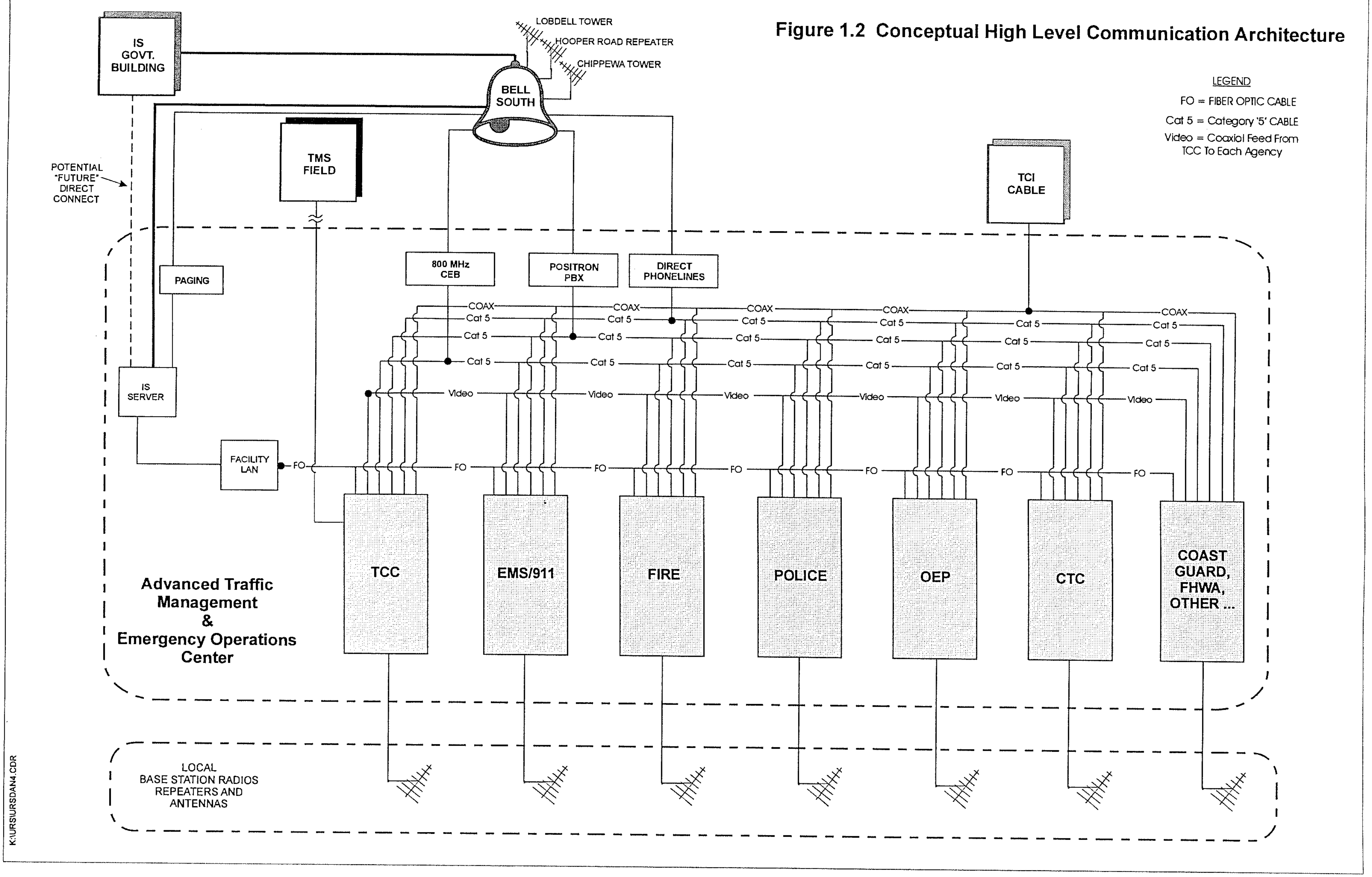
NOTE:

* These workstations provide a System function and may be relocated to the computer room or into an agency's office location.

** Operations Chief to be moved to an office

Another important consideration for the ATM-EOC is the internal computer network structure and the ability for data exchange and sharing. The recommended conceptual computer network structure is based on a Local Area Network (LAN) or Ethernet Platform and will support expandability over time without major redevelopment of the basic network structure. It is recommended that all departments and agencies at the ATM-EOC move towards a centralized server structure to maximize data exchange efficiency, yet minimizing operational costs. A centralized server structure requires that all file servers and PC file servers be located in the central computer room. A conceptual high level communications architecture for the ATM-EOC is presented in *Figure 1.2*.

Figure 1.2 Conceptual High Level Communication Architecture



Traffic Management Center Equipment and Systems

Equipment required for the Advanced Traffic Management System (ATMS) functions in the TMC portion of the ATM-EOC will ultimately depend on the design of the ATMS. At this phase of development, these requirements are based on the physical system architecture and logical system architecture presented in the ITS Early Deployment Study. The final design of the first phase of the ITS deployment will provide the specific details for final system components and systems integration. However, at this point, the physical building requirements are based on the ITS system architecture and Strategic ITS Deployment Plan defined in the ITS Early Deployment Study and provide a realistic expectation of the long-term physical characteristics/requirements for system equipment.

The following represents the anticipated system development scenario.

1. The TMC computer system will be a distributed PC type, where individual PCs will control each sub-system of the ATMS. These individual PCs will be connected together and to operator workstations over a LAN.

2. Subsystems will be included in the ATMS that provide for basic TMC functionality, as well as others which provide added amenities for non-operational support. Only the basic functionality subsystems will be included in the initial phase, and other systems will be included in subsequent phases. These subsystems include, but are not limited to:

   - ATMS LAN Server (the ATM-EOC will have a facility LAN Server for this)
   - CCTV Control Computer
   - Dynamic Message Sign Computer
   - Traffic Flow Monitoring Computer
   - Traffic Classification Computer
   - Traffic Signal Control Computer
   - HAR System Computer
   - Video Wall Display Control Computer
   - Roadway Weather Station Computer
   - Weather Monitoring Computer
   - World Wide Web Site Server
   - Image Capture Server (feed camera shots to web server)
   - E-mail Server
   - Newsgroup Server
   - Remote Access Server
   - Hotline Phone System
   - Operations Database Server
   - Maintenance Database Server
   - Lane Control Computer
   - Communications Network Monitoring Computer

3. The ATMS communications equipment will be consistent with the communications subsystem design approach presented previously.

4. Video cameras and distribution equipment will use analog video signals.

5. Video feeds will be provided to a local independent service provider (ISP) and/or local media outlets, with provisions for the capability of TMC personnel blocking any particular video feed before distribution.

6. There will be a facility based Ethernet/LAN which will include an ATMS server for distribution to various office equipment, presentation equipment, and networks.

CCTV Video Distribution

One of the primary physical components which will be deployed in the field will be CCTV video cameras. The images captured by these cameras will have high utilization value to the rest of the agencies co-located at the ATM-EOC. *Figure 1.3* identifies the preliminary distribution concept for these images at a specific equipment level detail. There are several 'Note' indicators within this diagram that are described as follows:

1. This circuit de-multiplexes video to the video matrix switcher via (1) coaxial cable per field camera. (200 cameras = 200 coaxial cables = 200 inputs to video matrix switcher.)

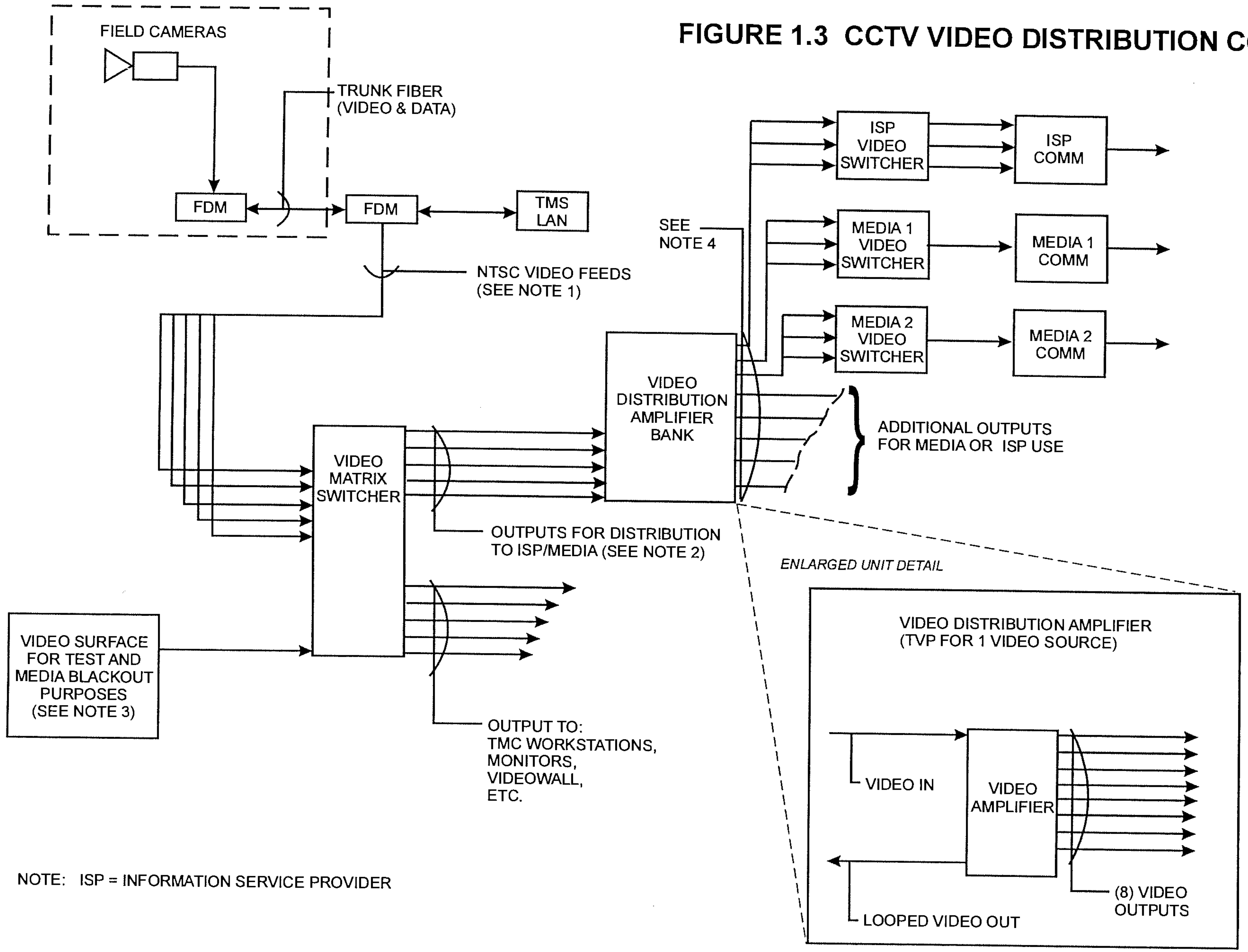
2. This circuit transports matrix-switched video from the switcher to the video distribution amplifier bank via (1) coaxial cable per video channel. (200 switcher outputs = 200 coaxial cables = 200 inputs to amplifier bank.)

3. A video signal generator is provided here as an input to the video matrix switcher. In the event of the reception of video that is deemed unsuitable for release to the public, this input can be routed to the switcher output(s) feeding the distribution amplifier bank. Thus replacing the undesirable video with a test pattern or text indicating that video is not available at this time.

4. These circuits transport video from the video amplifier distribution bank to the ISP/media video switchers via (1) coaxial cable per video channel per media or ISP outlet.

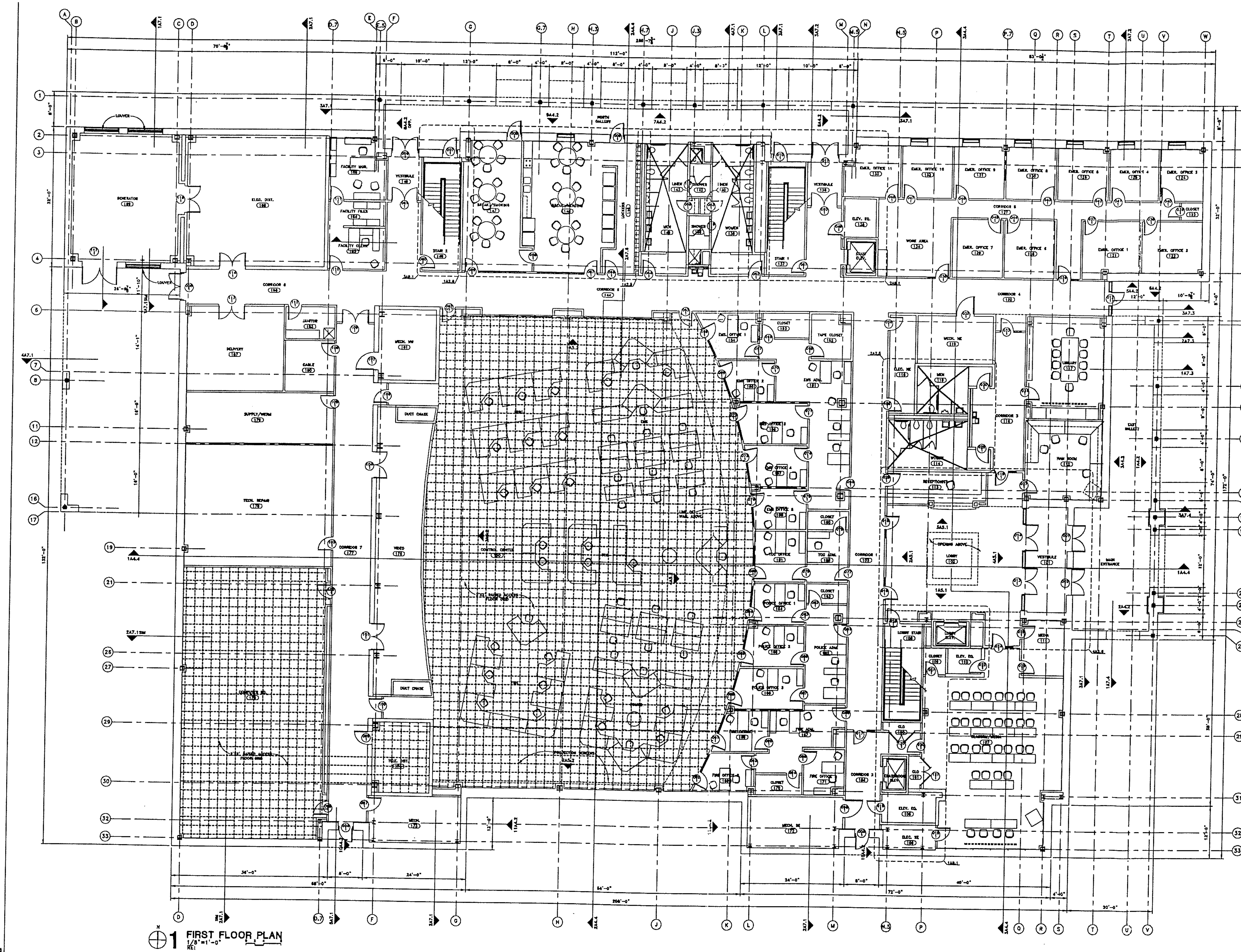
Preliminary facility layout plans have also been developed for the ATM-EOC. *Figures 1-4 and 1-5* illustrate the facility layout plans which have been developed in coordination with the preparation of the ITS Early Deployment Study and the Preliminary Implementation Plan. The facility plans include details relative to the central control room with console and video monitoring equipment locations designated, the central computer room, communications room and required office spaces for the TMC operation as well as that of the other agencies involved including Fire, Police EMS and OEP. The facility is being designed to accommodate the ATMS equipment and systems previously documented as well as to support the conceptual communications architecture and Local Area Network (LAN).

FIGURE 1.3 CCTV VIDEO DISTRIBUTION CONCEPT



NOTE: ISP = INFORMATION SERVICE PROVIDER

WC K:\URS\98B059\VIDEODISTRIB.CDR



$\oplus$ 1 FIRST FLOOR PLAN
1/8"=1'-0"

FIGURE 1-4
ATM-EOC FACILITY
LAYOUT PLAN
(FIRST FLOOR PLAN)

POST
ARCHITECTS

12032 Briarcourse Ave., Baton Rouge, LA 70816
TEL (504) 293-6964 FAX (504) 293-5169

ADVANCED TRAFFIC MANAGEMENT
&
EMERGENCY OPERATIONS
CENTER
SP 742-17-0120
FAP CM-HP-MISC (E76)
CP 97-MS-CP-0040
HARDING BLVD. NEAR AIRPORT
BATON ROUGE, LOUISIANA

NO.	REVISIONS	DATE

FIRST FLOOR PLAN

PROJECT NO. 9737	SHEET NO.
DRAWING FILE A2-1EOC.DWG	A2.1
DRAWN/CHECKED	
DATE	SHEET - OF

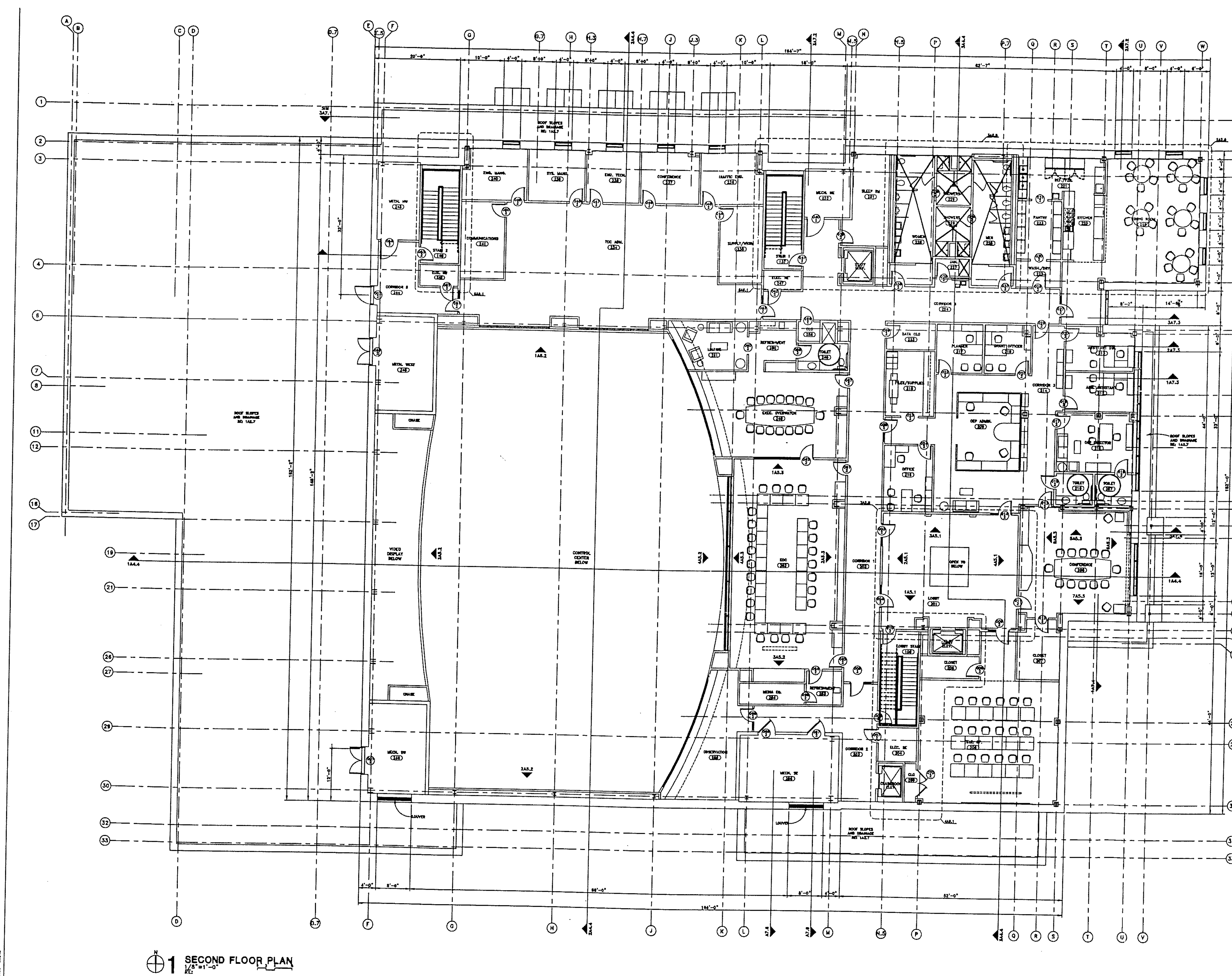


FIGURE 1-5
ATM-EOC FACILITY LAYOUT PLAN (SECOND FLOOR PLAN)

POST ARCHITECTS
12032 Brisbane Ave. Baton Rouge, LA 70816
TEL (504) 293-6864 FAX (504) 293-5188

ADVANCED TRAFFIC MANAGEMENT & EMERGENCY OPERATIONS CENTER
SP 742-17-0120
FAP CM-HP-MISC (876)
CP 97-MS-CP-0040
HARDING BLVD. NEAR AIRPORT
BATON ROUGE, LOUISIANA

NO.	REVISIONS	DATE

SECOND FLOOR PLAN

PROJECT NO. 9737	SHEET NO.
DRAWING FILE A2-2EOC.DWG	A2.2
DRAWN/CHECKED	
DATE	

The Traffic Management Center (TMC) component of the ATM-EOC facility will be operated and maintained by the City/Parish government. The City/Parish will maintain the property and building structure including electrical and mechanical components. The City/Parish will pay for power consumption for components within the TMC, provide staffing to operate the Advanced TMC and maintain all associated hardware and software which resides within the TMC. Details regarding staffing and annual operations and maintenance costs are provided in *Section 4.0.*

1.11 Project Phasing and Scheduling

The deployment of the proposed Intelligent Transportation System for the Baton Rouge Metropolitan Area will include the construction of the ATM-EOC, installation of field devices (i.e., variable message signs, cameras, traffic detectors, etc.), acquisition of telecommunication services, and the integration of the system to effectively operate the system. Such a broad scope of tasks which includes traditional "bricks and mortar" construction to software integration and development will require that important project milestones be incorporated into a project schedule for construction and integration tasks.

A review of formalized project scheduling and tracking systems utilized for similar project within the United States demonstrated that most state DOT's utilize some form of project scheduling and often require that critical-path-method (CPM) schedules be developed and routinely submitted as part of the construction contract. However, specific requirements for CPM software varied, as shown below.

State DOT	Requirements for Scheduling Software
Florida	Generally require CPM for projects >$5 million Preference to use Primavera Project Planner
California	Generally require CPM for projects > $7 million or Longer than 1 year in construction time Preference to use Primavera Project Planner or equal
Texas	Require development of Project Management Plan including schedule. Must be submitted in hardcopy and electronic format.
Colorado	Requires development of CPM schedule based on complexity of project. Microsoft Project preferred.

Research of current CPM software packages revealed over 70 commercial packages available today. The predominate CPM software titles included Microsoft Project and Primavera Project Planner. Such products have proven reliability and generally available staff capable of preparing and maintaining such a schedule. Once the design of the near term Freeway Management System from LA 1 to the I-10/I-12 interchange is complete a project schedule for implementation and integration should be developed utilizing one of these two software packages.

Schedule milestones will need to be identified. Such milestones should be well defined and unambiguous. In addition, such milestones should have a clear definition of completion. This will avoid confusion regarding whether a milestone is clearly complete or not.

2.0 Procurement Methods

An important consideration relative to the successful operation and deployment of an ITS Traffic Management System is the selection of a particular contracting arrangement for deploying ITS systems.

In the ITS Early Deployment Study several procurement strategies and contracting options were identified and discussed. During the course of this study several discussions were held with City/Parish and LDOTD personnel relative to the different procurement methods previously identified in the ITS Early Deployment Study.

The procurement method to be utilized for implementation of the Advanced Traffic Management System in the Baton Rouge Region will be the "System Manager Approach".

System Manager Approach

Contracting for the System Manager's services falls under the Engineering and Design Services contract category which includes services such as program and construction management, engineering, design, and surveying. Using the plans and specifications developed by the System Manager, a contract for furnishing and installing field equipment such as CCTV cameras, dynamic message signs, and conduit systems, is let, using traditional contracting procedures as in the contract-bid category of contracting. However, a key difference comes into play. The consultant's responsibilities carry into the deployment phase of the system under this approach. The consultant is responsible for the final design and development of software and for integrating it with the hardware as it is installed and for providing documentation and training to operating staff in the use of the integrated system.

Several advantages to the System Manager approach have been noted as follows:

- The process includes competitive bidding, with all of its benefits, for the furnishing and installing of field equipment hardware, and for facility and electrical construction.
- Access to those developing the system software, and agency control over system development, are greatly facilitated. If the control system hardware is included with the software bid, a hardware contractor who does not produce software could win the bid. The hardware company will subcontract the software to a software company. The client then has very limited access and control over the system development and may not be able to ensure that the system meets its requirements.
- The system manager approach gives the flexibility to incorporate the latest technologies into the system, as well as to provide integration with other traffic control systems which may be operating on other roadway networks. It is important to avoid the low-bid syndrome, where the software is designed to do the absolute minimum required to meet the specifications rather than take advantage of the latest thinking and processes in a rapidly evolving technological market.

Procurement for services will be performed by LDOTD with contract management and oversight being performed by LDOTD in coordination with the City/Parish government.

The procurement of design services for the ATM-EOC building was initiated by the City/Parish government with local funds. The design of the facility is nearing completion and a construction letting date has been established for April, 1999. Procurement services for the System Manager is slated to be initiated in Spring of 1999 following the award of the ATM-EOC construction contract. Funding for the System Manager services including management, design and integration services is programmed in the local Transportation Improvement Program (TIP).

3.0 Institutional Arrangements

The planning, implementation, and operation and maintenance of the proposed Advanced Traffic Management System (ATMS) will involve numerous organizations and multiple levels of government. In this section the organizational structure and responsibilities for the various elements of the ITS system will be discussed.

Included will be a discussion of the roles of the Advisory Committee and the Steering Committee as well as listings of the organizations and contact persons residing on each of these committees.

To begin with, a listing of key participating and coordinating organizations along with a list of cooperating municipalities is provided (See *Table 3.1)*. Project liaisons are also identified for each organization and municipality.

Table 3.1 - Participating and Coordinating Organizations

Organization	Project Liaison
East Baton Rouge Parish/City of Baton Rouge Government	
Mayor's Office	Mr. Jim Brewer
Department of Public Works	Mr. Fred Raiford
Baton Rouge Fire Department	Ms. Robin Hurst
Baton Rouge City Police	Mr. Mike Coulter
Office of Emergency Preparedness	Ms. JoAnne Moreau
EMS (911)	C. J. "Red" Delatte
Greater Baton Rouge Airport District	Mr. Anthony Marino
Louisiana Department of Transportation and Development	
Planning Division	Mr. Coan Bueche
State Traffic Engineer	Mr. Chris Orillion
District 61 Traffic Engineer	Mr. Ronnie Carter
Transit Division	Ms. Carol Cranshaw
Louisiana Transportation Research Center	Mr. Joe Baker
Other Organizations	
Capital Transportation Corporation	Ms. Debbie Moore
Capital Region Planning Commission	Mr. Huey Dugas
State Police/Louisiana Emergency Response Commission	Major Mark Oxley
Louisiana Motor Transport Association	Ms. Kathy Gautreaux
Port of Greater Baton Rouge	Mr. Roger Richard
Louisiana Chemical Association	Mr. Dan Borne
Baton Rouge Chamber of Commerce	Mr. Don Powers
Municipality	**Project Liaison**
City of Denham Springs	Mayor James DeLaune
West Baton Rouge	Mr. Ted Denstel, Parish President
Ascension Parish	Mr. Tommy Martinez, Parish President
Livingston Parish	Mr. Dewey Ratcliff, Parish President
City of Port Allen	Mayor, Lynn Robertson
City of Baker	Mayor Bobby Simpson

Organizational Responsibilities

While there are numerous participating and coordinating agencies associated with ITS deployment within the Baton Rouge Metropolitan Area, the two organizations which will be primarily responsible for implementation and operation and maintenance of the Advanced Traffic Management System (ATMS) are the East Baton Rouge Parish/City of Baton Rouge Government (hereafter referred to as the City/Parish Government) and the Louisiana Department of Transportation and Development (LDOTD).

The City/Parish Government lead by the Mayor has been the champion for the development of the Advanced Traffic Management and Emergency Operation Center (ATM-EOC). The City/Parish Government and LDOTD entered into an agreement October 9, 1998 (See *Appendix B*) which states that the City/Parish Government will be responsible for the complete operation of the ATM-EOC, including the Traffic Management Center (TMC) component. The agreement also goes on to state that the City/Parish Government shall have full and complete authority to operate and control all traffic devices on all Federal, State, and local routes. However, LDOTD reserves the right to monitor all traffic operations and in emergency situations, retains the override authority on all Federal and State routes.

The City/Parish Government will be responsible for the following:

- Maintenance of the physical structure (ATM-EOC building).
- Supplying power for operations of equipment at the TMC.
- Maintenance of hardware, software and other equipment located within the TMC.
- Providing necessary staffing for the operations of the TMC (See *Section 4.0* for staffing and organization details).
- Operating traffic control devices on Federal, State, and local routes associated with the ITS Freeway Management and Advanced Surface Street Control System which are integrated into and are part of the Baton Rouge Advanced Traffic Management System as identified in ITS Early Deployment Study.

The operations and maintenance of the TMC will be performed under the direction of the City/Parish Government Department of Public Works.

The LDOTD will be responsible for maintenance of field traffic control devices within LDOTD right-of-way, including power distribution and communications equipment not owned and/or maintained by a private utility provider. LDOTD will also be responsible for annual power usage expenses and associated communication leases which may be required. The LDOTD will contract for maintenance services to maintain ITS field located traffic control devices within LDOTD right-of-way. Provisions for spare parts and storage of spare parts will be included in the maintenance service contract.

Design services for the ATM-EOC were procured by the City/Parish Government utilizing local funds and the design of the facility is near complete with procurement of a contractor for construction scheduled to be let in April, 1999. Future procurement of services for the design, integration and implementation of the Advanced Traffic Management System will be conducted by LDOTD in cooperation with the City/Parish Government consistent with the procurement strategy outlined in *Section 2.0*

The City/Parish Government Traffic Engineering Division currently operates and maintains all signalized intersections within the Baton Rouge City limits (both City owned, and LDOTD owned) via an existing operation and maintenance agreement between LDOTD and the City/Parish Government.

The operation and maintenance of the existing computerized traffic signal system is inclusive in this agreement. The Advanced Surface Street Control Plan as outlined in the ITS Early Deployment Study identifies additional signalized corridors to be upgraded and integrated into the regional Advanced Traffic Management System (ATMS). Many of these corridors and associated signalized intersections slated for upgrade and integration are within the city limits of Baton Rouge and are covered under the existing operation and maintenance agreement. However, when corridors identified in the Advanced Surface Street Control Program which fall outside of the jurisdictional limits of the existing agreement are improved and integrated into the ATMS, the existing agreement will be modified to include operation and maintenance for those corridors and associated signalized intersections.

The Motorist Assistance Patrols (MAP) and the Roadway Incident Management (RIM) patrols are currently funded through LDOTD in association with the on-going interstate reconstruction project along I-10 and I-12 from approximately Acadian Throughway to Airline Highway serving as a congestion mitigation measure for construction related impacts. LDOTD will continue funding the MAP and RIM patrols through the completion of the I-10/I-12 reconstruction project and are committed to maintaining funding during the reconstruction and widening project of I-10 from the I-10/I-12 split to Siegen Lane (scheduled to be let in October 2002) and the I-12 pavement replacement and widening project from O'Neal Lane to Range Avenue (scheduled to be let in January of 2004). This will assure the continued funding of the MAP and RIM patrols through the near term and well into the mid term. Once the interstate reconstruction projects are completed the MAP and RIM patrols will be consolidated into one Freeway Incident Response Patrol and funding will be continued utilizing dedicated CMAQ funds with match provided by LDOTD.

The current MAP patrol is performed by a private contractor via an existing contractual agreement between the contractor and LDOTD. The RIM patrols are currently performed by the Baton Rouge City Police through an agreement with LDOTD. Once the ATM-EOC is functional, the MAP and RIM patrol operations will be integrated into the ATMS operations and will be coordinated through the ATMS Manager. Communications between traffic controllers at the TMC and in-vehicle MAP and RIM patrol personnel will be implemented utilizing RF and cellular communications.

The lead organization for the Advanced Public Transit component will be the Capital Transportation Corporation (CTC). The local transit agency, CTC will be responsible for procurement, operations and maintenance of the proposed Advanced Vehicle Tracking System, Automated Schedule Tracking System, Demand Response Transit System and Load and Fare Management.

The CTC will operate the Advanced Public Transit System from the Transit Management Center to be located at the new CTC facility located on Florida Blvd. The CTC operations will be integrated into the TMC operations via a communication link, which will allow for data exchange and sharing data relative to real time traffic conditions, and incident locations. This data will be made available to CTC personnel at the Transit Management Center. As previously noted, the CTC will also have a designated command workstation in the central control room at the TMC in which all data and video will be available. Real time schedule adherence information for transit and para-transit vehicles will be supplied to the information service provider (to be determined) for dissemination to the public.

Emergency management functions will be integrated into the TMC operations. The lead agency relative to emergency management on the local level will be the City/Parish Government Office of Emergency Preparedness (OEP) and the lead state agency will be the Louisiana State Police. All integration of emergency management operations will be closely coordinated between the ATMS Manager, the City OEP Director and State Police in close cooperation with the Baton Rouge City Fire Department, Police and EMS 911 operation. All of these agencies will be resident at the ATM-EOC and will have a command workstation located in the central control room with full access to all real time traffic, incident, and video surveillance data via the Video Projection System and the Local Area Network.

As previously noted, ITS Commercial Vehicle Operation (CVO) initiatives are statewide deployment oriented and not specific to the Baton Rouge Metropolitan Area. The State of Louisiana and State administrative and regulatory agencies for commercial vehicle operations must take the lead for deployment. The LDOTD in cooperation with the Louisiana Motor Transport Authority will be the coordinating agencies for any ITS CVO statewide initiatives which impact the Baton Rouge Metropolitan Area.

The planning, research and performance evaluation of existing and future ITS deployments within the Baton Rouge region will be the responsibility of CRPC, LTRC, and the LDOTD Planning Division. CRPC in coordination with the LDOTD Planning Division will be responsible for future ITS planning within the Baton Rouge metropolitan region. LTRC will be the primary research organization. Performance evaluation of implemented ITS components will be shared between CRPC and LTRC.

The cooperating municipalities previously listed at the beginning of this section have voiced their support, concurrence for deployment within their jurisdiction, and cooperation for deployment of the proposed ITS Deployment Program as outlined in the ITS Early Deployment Study. All ITS components to be deployed within these municipalities will be within LDOTD right-of-way. These municipalities will not be responsible for implementation, operation, or maintenance of the proposed ITS system.

Advisory Committee

An Advisory Committee has been established to develop and set policy and procedures for the operation of the Advanced Traffic Management System within the Baton Rouge region. The Advisory Committee is comprised of representatives from the lead organizations responsible for implementation, operations, and maintenance of the system as well as some cooperating agencies. The following is a listing of Advisory Committee organizational members and committee representatives.

Mayors Office – Jim Brewer
EBR DPW – Fred Raiford
DOTD District Traffic Engineer – Ronnie Carter
DOTD State Traffic Engineer – Chris Orillion
State Police – Mark Oxley
FHWA – Frank Grabski
CTC – Debbie Moore
Metropolitan Airport Director – Anthony Marino
Director of Public Safety – To be appointed
Capital Regional Planning Commission – Huey Dugas

An updated and revised Steering Committee comprised of the key participating and cooperating agencies has also been established. The function of the Steering Committee is to oversee and direct the planning and development of ITS within the Baton Rouge Transportation Management Area.

Table 3.2 - Revised Steering Committee (1/16/98)

Mr. Tony Sussman FHWA Post Office Box 3929 Baton Rouge, Louisiana 70821	Mr. Frank Grabski FHWA Post Office Box 3929 Baton Rouge, Louisiana 70821
Mr. Chris Orillion LDOTD – District 45 Post Office Box 15337 Baton Rouge, Louisiana 70895	Mr. Fred Raiford East Baton Rouge Parish Post Office Box 1471 Baton Rouge, Louisiana 70821-1421
Ms. Cathy Gautreaux LA Motor Transport Association Post Office Box 80278 Baton Rouge, Louisiana 70898	Mr. Mike McCleary Capital Transportation Corporation 1111 Seneca Street Baton Rouge, Louisiana 70805
Major Mark Oxley Louisiana State Police/ Louisiana Emergency Response Commission State Troop A 17801 Highland Road Baton Rouge, Louisiana 70810	Mr. Huey Dugas Capital Region Planning Commission Post Office Box 3355 Baton Rouge, Louisiana 70821
Dr. Olin Dart, Chairman CRPC TAC Committee 8775 Airline Highway Baton Rouge, Louisiana 70807	Mr. Roger Richard Port of Greater Baton Rouge Post Office Box 380 Port Allen, Louisiana 70767
Mr. Anthony Marino Greater Baton Rouge Airport District Ryan Terminal, Suite 212 Baton Rouge, Louisiana 70807	Mr. Coan Bueche Louisiana Department of Transportation and Development Post Office Box 94245 Baton Rouge, Louisiana 70804-9245
Mr. Ronnie Carter LDOTD – District 61 Traffic Engineer Baton Rouge, Louisiana	Ms. JoAnne Moreau Office of Emergency Preparedness P.O. Box 1471 Baton Rouge, Louisiana 70821
Mr. Joe Baker Louisiana Transportation Research Council 4101 Guorrier Ave. Baton Rouge, Louisiana 70808	

Provisions for periodic updates on the status of ITS deployment and planning initiatives to Advisory Committee members, Steering Committee members, and other participating and cooperating organizations listed at the beginning of this section are as follows; the ATMS Manager will prepare a summary of the most recent ITS deployment status and ongoing planning initiatives on a quarterly basis for distribution to all committee members and organizations referenced above.

Legislation

Several issues have been discussed relative to existing regulations and policies affecting implementation of the proposed ITS deployment. However, most issues noted through the "Preliminary Implementation Plan" development process have been previously addressed via implementation of legacy ITS systems. The City/Parish Government and LDOTD, the two primary agencies planning to implement, operate and maintain the proposed ITS system have an existing agreement in place which allows the City/Parish Government to operate and maintain specified traffic signal control equipment located within LDOTD right-of-way, setting a precedent for the City/Parish to operate and maintain specified advanced traffic control systems (ITS equipment) on state routes and within LDOTD right-of-way. The LDOTD also operates a Motorist Assistance Patrol (MAP) program and Roadway Incident Management (RIM) patrol through existing agreements with the City/Parish Government through the City/Parish Police Department for the RIM Patrol and Jack B. Harper Contractor, Inc. for the MAP Patrol. Procedures and guidelines have been established for the MAP and RIM patrols through these agreements.

The LDOTD has also implemented several ITS related systems and currently operates and maintains these systems with in-house staff and/or through agreements with other agencies or private contract maintenance providers. Previous ITS related systems and equipment which have been deployed include computerized traffic signal systems, highway advisory radio, vehicle detection stations on both arterial and interstate roadways, and variable message signs (portable), typically in and adjacent to construction zones.

There is one ITS component slated for deployment in the interim and near term, which has not been implemented by the City/Parish Government nor LDOTD, CCTV surveillance cameras. These cameras would be utilized along arterial streets and the interstate system for traffic monitoring, incident detection, incident verification, and monitoring of incidents during response through incident clearance. While it appears there are no impediments relative to existing laws, regulations and policies affecting the deployment of CCTV cameras on the interstate and arterial streets within the State of Louisiana or the City/Parish of East Baton Rouge for traffic and incident management purposes, this issue is being further researched by the City/Parish Government and LDOTD legal staff to verify.

4.0 Personnel & Budget Resources

An important component of ITS systems implementation is the operations and maintenance of the system. The central point of operations for the Baton Rouge area wide Advanced Traffic Management System will be the Traffic Management Center (TMC) component of the ATM-EOC to be located on Harding Boulevard.

As outlined in the attached agreement executed in October 1998 (see *Appendix B*, located at the end of this document), the TMC will be operated by the City/Parish Government. The TMC will be operated under the direction of the City/Parish Director of Public Works. An ATMS Manager will be appointed to manage the TMC and will work under the direction of the City/Parish Director of Public Works.

As previously mentioned in *Section 3.0*, in order to develop policy and procedures and to avoid conflicts or misunderstandings concerning operations, an Advisory Committee will be established.

This Advisory Committee will set overall polices and procedures for the operations of the ATMS system in Baton Rouge but will not be involved in day-to-day management and operations of the TMC. Members of the Advisory Committee are listed in *Section 3.0*. Subcommittees involving Fire; Police; EMS; Emergency Operations Center management personnel; representatives of West Baton Rouge, Livingston and Ascension Parishes; and the municipalities of Denham Springs, Port Allen and Baker will be utilized to develop consensus agreements by all relevant parties to policies and procedures where necessary.

Job Functions and Descriptions

One of the first job functions to fill will be that of the ATMS Manager. This person will be responsible for the overall ATMS system development, operations, and maintenance. This person will provide coordination for future ITS deployment, coordination with other agencies and organizations, and work closely with the Advisory Committee to develop and implement policies and procedure for incident and freeway management. Another key responsibility will be to financially manage the operation by developing budgets and being responsible for operating within these budgets.

An Operations and Maintenance Supervisor will also be required. From the operations side this person will provide day-to-day supervision and scheduling of ATMS Controllers and will also be available to support system controllers during a major incident, to provide a higher level liaison with other agencies and the media, and to serve as a back-up person if regular operations personnel are not available. The Operations and Maintenance Supervisor will also be responsible to ensure that new operations personnel are trained properly and to ensure that current staff are trained on new equipment and that refresher training is conducted for all personnel.

From the maintenance side, this person will be responsible for supervision of the contract maintenance provider to ensure that preventative maintenance is being performed according to schedule, and system malfunctions and/or maintenance needs are responded to promptly.

In the "Interim Phase", due to the limited operations, the ATMS Manager will also provide the function as the Operations and Maintenance Supervisor, and will be involved in the day-to-day operations at the TMC facility.

ATMS controllers will be required and will have numerous responsibilities including:

- Monitoring of CCTV screens and computer displays to verify traffic conditions and incidents on the ITS network.
- Systems operation to select different displays and messages to control field devices, such as Dynamic Message Signs, CCTV cameras, and Highway Advisory Radio.
- Coordination using communication equipment with incident response personnel during an incident.
- Down loading of timing plans and monitoring the computerized traffic control system.
- Providing relevant information to the information service provider and the media.
- Maintaining logs and other required records of incidents and activities.

Office support services will be required and will include a secretary/receptionist to provide clerical support. This person will have shared duties with other organizations within the ATM-EOC.

Maintenance technicians will be required including electronics and system technicians who are experienced in electronics, communications, power distribution, cable installation and repair, portable generators, and general small-scale mechanical repairs. Due to the diversity of equipment and potential malfunctions, a broad range of general repair capabilities is required. The maintenance technicians will also be responsible for troubleshooting and problem identification, to quickly identify and correct problems. Preventive maintenance, locating and repairing small problems before they become major and conscientious record keeping and documentation are also typical responsibilities of maintenance technicians.

Organization and Staffing

When the TMC facility opens the "Near Term Deployment Plan" as described in the ITS Early Deployment Study will not be complete; however, the "Interim Deployment Plan" will be operational concurrent with the opening of the TMC. A proposed Interim Organizational Chart showing the organization and staffing scheme during the "Interim" period between the opening of the TMC and the completion of the proposed "Near Term Deployment" is shown in *Figure 4.1.*

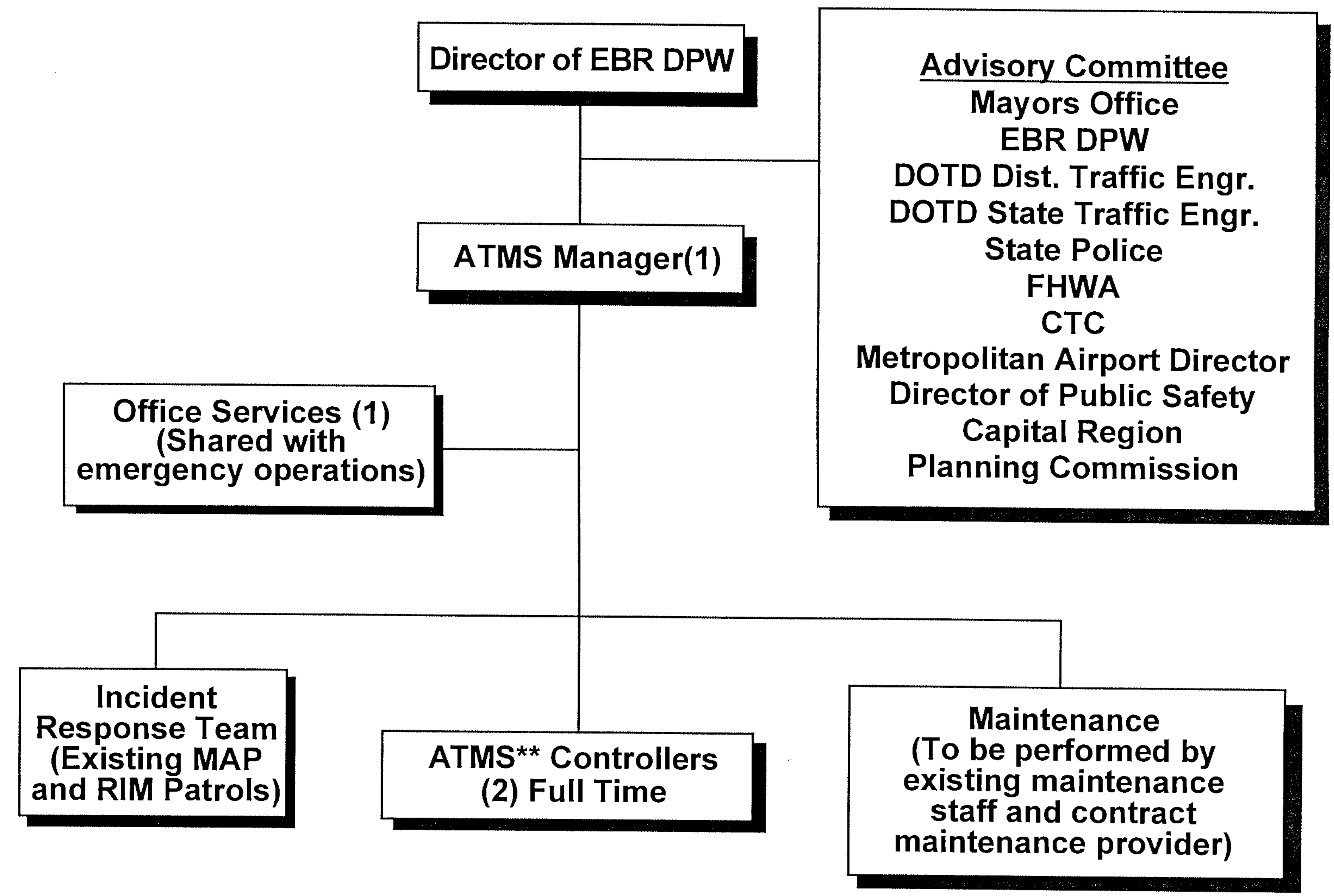
The organizational chart shows the entire TMC operation will fall under the direction of the City/Parish Director of Public Works. The ATMS Manager will report directly to the Director of Public Works and be the primary liaison between the ATMS staff and the Advisory Committee regarding development of operating policies and procedures. Office administrative and clerical support will utilize a shared person with other emergency operations staff within the ATM-EOC.

As noted in *Section 1.5*, during the "Interim" period the days and hours of operation for the TMC will be five days per week, Monday through Friday, from 6:00 AM to 7:00 PM. Two ATMS controllers will be required with the support of the ATMS Manager to assure two persons will be on duty during all operating hours. Under this staffing and scheduling scenario two ATMS controllers would work alternating shifts weekly, with support from the ATMS Manager. Shifts would work as follows:

Staffing	Week 1		Week 2	
Controller 1	M, T, W	6:00 AM to 7:00 PM	M, T, W	6:00 AM to 10:00 AM
	TH, F	6:00 AM to 10:00 AM	TH, F	6:00 AM to 7:00 PM
Controller 2	M, T, W	6:00 AM to 10:00 AM	M, T, W	6:00 AM to 7:00 PM
	TH, F	6:00 AM to 7:00 PM	TH, F	6:00 AM to 10:00 AM
ATMS Manager	M - F	10:00 AM to 7:00 PM	M - F	10:00 AM to 7:00 PM

ATMS controllers working the 6:00 AM to 7:00 PM shift would work 12 hours with a one-hour lunch break. ATMS controllers would work rotating 36 and 44-hour weeks, effectively equating to 40 hours per week. This schedule also maintains two persons on duty at all times during operating hours to assure when one person is on lunch break or must leave the control room for a brief period, at least one person will be monitoring the system. Utilizing this staffing and scheduling format both the AM and PM peak traffic periods during weekdays will be well covered.

Interim ATMS Organizational Chart



** ATMS - Advanced Traffic Management System

Figure 4.1

In the "Interim Phase", all ITS components are existing or legacy ITS systems with the exception of the five proposed CCTV cameras. Maintenance is currently performed by either existing LDOTD and City/Parish Government maintenance staff or through an existing contract maintenance agreement. In the "Interim Phase", system maintenance will continue to be performed utilizing existing staff and/or contract maintenance agreements.

During the "Interim Phase", the MAP and RIM patrols will continue their current operation with staffing and personnel provided through the City/Parish Police Department for the RIM patrols, and through LDOTD via a subcontractor for MAP services.

Near / Mid Term Organization and Staffing

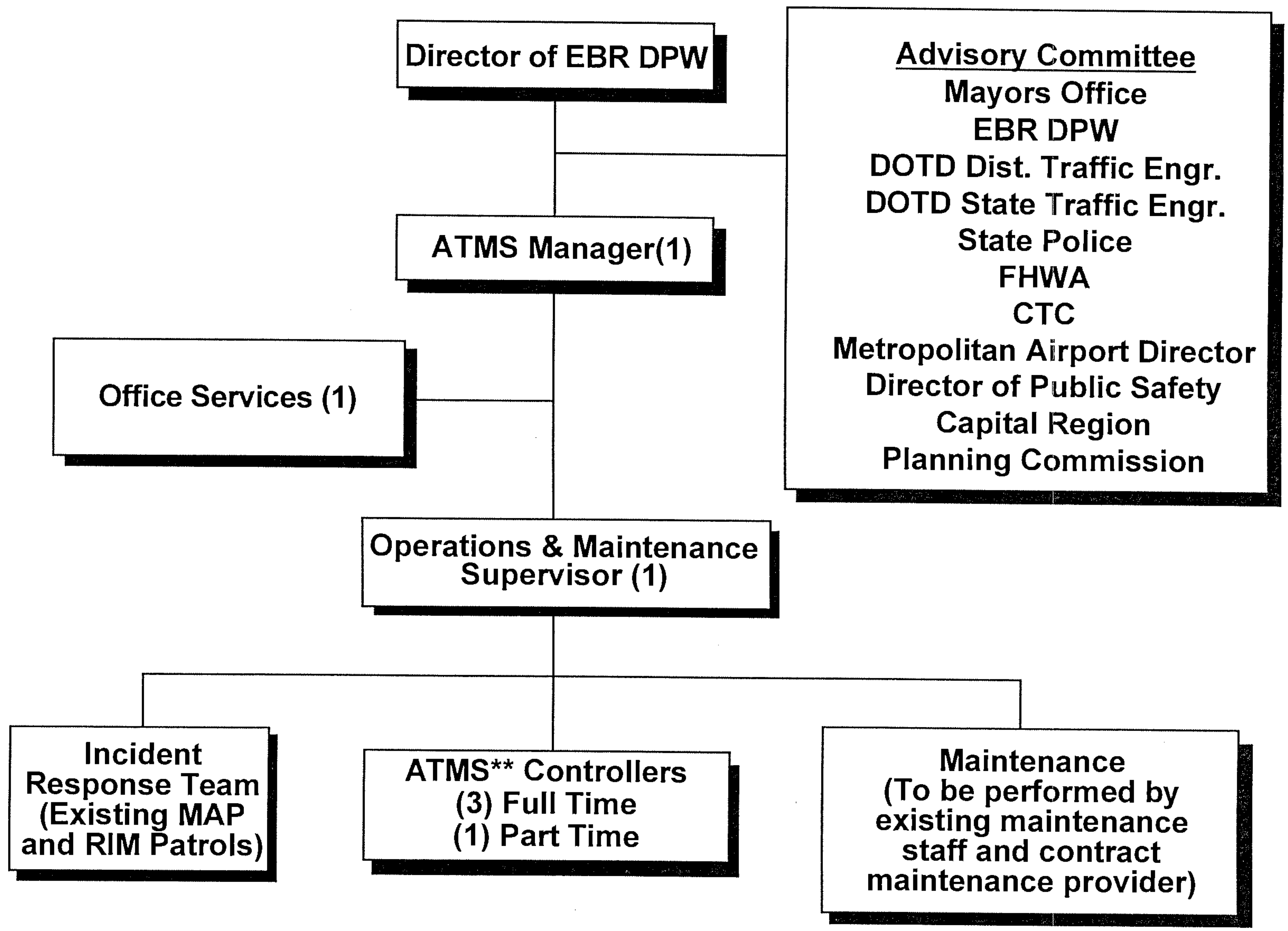
Once the "Near Term Component", (freeway surveillance and management, LA 1 to the I-10/I-12 interchange) is completed with full surveillance and communication capabilities, additional personnel will be necessary. A proposed near and mid term organizational chart for the operation of the system at that time is shown in *Figure 4.2*. This proposed organizational and management scheme will provide adequate staffing through the "Mid Term Deployment" and into the long term horizon.

The overall organization is basically the same as the "Interim Plan" with the exception that an Operations and Maintenance Supervisor will be required along with additional ATMS Controllers. The TMC operations will remain under the control of the City/Parish Public Works Director with the ATMS Manager reporting directly to the Public Work Director. The advisory committee will remain in place to dictate policy and procedures for operation. An Operations and Maintenance Supervisor will be hired to handle the day to day operations of the TMC including scheduling of ATMS Controllers and coordinating maintenance and incident response team activities. This will allow the ATMS Manager to focus on his/her primary responsibilities as previously described as the regional ITS system develops.

As noted in *Section 1.5*, as soon as the "Near Term" component from LA 1 to the I-10/I-12 split is complete, the days of operation will be expanded to seven days a week, with hours of operation during weekdays remaining the same, 6:00 AM to 7:00 PM, with weekend operating hours 8:00 AM to 6:00 PM. Four ATMS controllers with support from the Operations and Maintenance Supervisor will be required. Three full time Controllers and one part time Controller will be utilized. The following is the concept staffing and scheduling for the near and mid term operations.

The full time ATMS Controllers would work four consecutive 8-hour days and have two days off with four day shifts beginning on alternate days to assure that two persons are on duty during all hours of operation. This rotation repeats every six weeks with controllers averaging approximately 40 hours per week.

Near and Mid Term ATMS Organizational Chart



** ATMS - Advanced Traffic Management System

Figure 4.2

Concept Staffing and Scheduling and Shifts Plan (Near and Mid Term)		
Job Function	Days	Hours
ATMS Controller #1	4 on, 2 off (days vary)	6:00 AM – 300 PM *1
ATMS Controller #2	4 on, 2 off (days vary)	10:00 AM – 7:00 PM *1
ATMS Controller #3	4 on, 2 off (days vary)	6:00 AM – 3:00 PM (2 days) *1 10:00 AM – 7:00 PM (2 days) *1
ATMS Controller #4 (Part time)	M, T, W, TH, F	6:00 AM – 10:00 PM
O & M Supervisor	M, T, W, TH, F	6:00 AM – 3:00 PM
ATMS Manager	M, T, W, TH, F	10:00 AM – 7:00 PM

*1 Weekend shifts are 8:00 AM to 6:00 PM

This type of scheduling will assure two persons are working at all times during hours of operation. It is also intended that the part time ATMS Controller position will be filled utilizing existing City/Parish Government engineering staff with two existing staff members being trained in ATMS control to fill this part time position.

The Operations and Maintenance Supervisor will oversee and coordinate maintenance functions, however, maintenance service for the field deployed equipment associated with the Freeway and Incident Management System as well as supporting hardware and software components at the TMC will be performed by a contract maintenance service provider.

However, as previously noted the City/Parish Government and LDOTD do operate and maintain an extensive advanced traffic signal control program for arterial streets. Operations and maintenance of this system (both State and City owned) is performed by the City/Parish Government, Traffic Engineering Division for all signals within the City Limits through an existing operations and maintenance agreement with LDOTD. Both the City/Parish Government and LDOTD Traffic Engineering Divisions employ qualified staff and personnel to operate and maintain the existing and planned Advanced Surface Street Control System. These personnel will continue to be utilized for such operations and maintenance.

As previously noted, the Motorist Assistance Patrols (MAP) and a Roadway Incident Management (RIM) program are currently in place with adequate staffing and personnel provided through the City/Parish Police Department for the RIM patrols, and through LDOTD via a subcontractor for MAP services. These services will continue through the "Near and Mid Term Deployment" concurrent with existing interstate maintenance reconstruction projects. Once the reconstruction projects are complete, the two services will be consolidated into one incident response team with continuing service through the long term horizon.

Provisions for Training

The days and hours of operation along with required job descriptions, staffing and scheduling have been documented. The next issue to consider relative to staffing is training and preparing employees to operate the ATMS system. There are two key benefits relative to training provided through the implementation process noted within this document. The phased implementation approach will allow initially for a simpler, less complex system in which inexperienced staff can more quickly be trained. This also allows initial staff to master the less complex system before beginning training for future more complex systems and operations. The second important benefit of the proposed implementation process relative to training provisions is utilization of a System Manager.

The System Manager is typically responsible for design of the system, preparation of specifications, selecting off the shelf software, developing any on site specific software, integration of the system as well as providing training for staff relative to systems operation.

For the Baton Rouge ITS system, the System Manager will work in close coordination with the Advisory Committee to develop the Operating Guidelines for the ATMS System. The System Manager by contractual agreement will be responsible for training staff in the operation of the system including use of site specific and integration software. The System Manager will also provide documentation of site specific and integration software for use by staff. For use of specialized firmware and off-the-shelf software, the manufacturer or developer will provide training and documentation via specific training requirements written into the specifications when necessary. Due to the lack of locally available expertise in the operation of such a system, initially the System Manager will supply two contract staff ATMS controllers during the "Interim Operation". As local staff are trained and become competent in the use of the system, the City/Parish Government may choose to eliminate or maintain such contract services.

4.1 Funding Sources

In order to implement the planned ATMS, adequate capital funding must be available for constructing and equipping the Traffic Management Center and for the deployment of the field components of the ATMS. Adequate funding for operations and maintenance must also be available. The City/Parish Government in conjunction with CRPC and LDOTD have identified the ITS Program as high priority and have programmed substantial funding in the Transportation Improvement Program (TIP) for the planned deployment (TIP is typically only a three to five year element) utilizing a combination of local and federal funds. Capital funding presently programmed in the TIP for ITS deployment is as follows:

ATM-EOC/Traffic Management Center

The estimated cost for the Advanced Traffic Management Center is 10 million dollars. Funding in the amount of 9.75 million is available as follows:

CMAQ	$2.40 million
High Priority Demo	5.40
City/Parish Match	1.95
Total	$9.75 million

The Federal Demonstration funds will be received over a period of 6 years with 11% being available in the first Fiscal Year, 15% the second, 18% the third, 18% the fourth, 19% the fifth and the final 19% in Fiscal Year 2003. Since the construction of the Center is to start in 1999, it is obvious that sufficient Demonstration funds for the construction will not be available at that time.

In order to let the project in a timely manner, the City/Parish Government, DOTD, and FHWA have agreed that one of the allowable innovative funding techniques (Advance Construction) will be used. In this process, the City/Parish Government will provide local funding in the amount needed to supplement Federal funds available at the time of letting to construction.

The local funds used for replacement of unavailable Federal Demonstration funds at the time of construction letting will be returned to the City/Parish Government as the Demonstration funds become available in accordance with the previously cited schedule.

Field Deployment of the ATMS

1. Freeway Management System

To accomplish the recommended "Interim Plan" and the "Near Term Deployment" from the I-10/I-12 interchange along I-10 to LA 1, it is estimated that slightly less than 12 million dollars will be needed to complete these phases. Approximately 66 % of the funding to implement these phases, or 8.0 millions has been programmed into the Transportation Improvement Program (TIP) using CMAQ funds. The CRPC and the City/Parish Government are committed to programming the remaining funds in the 1999 TIP update process. Matching funds will be provided by LDOTD.

The Baton Rouge ITS Strategic Deployment Plan has been developed and phased consistent with reasonable levels of anticipated future annual revenue streams (federal, state and local) necessary to fund the mid and long term components of the strategic plan. CRPC in conjunction with the City/Parish Government and LDOTD will take action in the Long Range Financially Constrained Transportation Plan Update Process to program mid and long term elements of the ITS Plan into the Long Range Transportation Plan.

2. Advanced Surface Street Control

The City/Parish Government in cooperation with LDOTD presently operate computerized signal systems which are managed and maintained by the City/Parish Government Department of Public Works, Traffic Engineering Division, located at 329 Chippewa Street in Baton Rouge.

The third phase of the computerized signal replacement plan (*referenced in Section 8.0 of the ITS Early Deployment Plan as "Priority 1")* is under design with construction scheduled for August 1999. Funding for this phase in the amount of 3.3 million dollars is included in the Transportation Improvement Plan (TIP) for Fiscal Year 1999.

Two additional phases of computerized signals are included in the TIP. Phase 4 & 5 *(referenced in Section 8.0 of the ITS Early Deployment Plan as "Priority 2")* are funded as follows:

Phase	Fiscal Year	Design	Construction	Funding Type
4 and 5	1999	$1,000,000		CMAQ
4	2001		$3,000,000	High Priority Demo
5	2002		$4,500,000	CMAQ

A total of 4.875 million dollars in high priority demonstration funds was allocated for installing computerized signal systems in Baton Rouge. Therefore, an additional 1.875 million dollars in high priority demonstration funds will be available for future computerized signal projects; more specifically, Priority 3 as defined in the ITS Early Deployment Study. Consistent with the Long Range Financially Constrained Transportation Planning Process, future phases documented in the "Mid Term Deployment" will be programmed into the Long Range Plan for eventual future inclusion into the TIP.

Operations and Maintenance Funding

The City/Parish Government and LDOTD will share operation, maintenance and funding responsibilities. As previously noted, the City/Parish will operate and maintain the TMC including the following:

- Maintenance of the physical structure (ATM-EOC building).
- Supplying power for operations of equipment at the TMC.
- Maintenance of hardware, software and other equipment located within the TMC.
- Providing necessary staffing for the operations of the TMC (See *Section 4.0* for staffing and organization details).
- Operating traffic control devices on Federal, state and local routes associated with the ITS Freeway Management and Advanced Surface Street Control System which are integrated into and are part of the Baton Rouge Advanced Traffic Management System as identified in ITS Early Deployment Study.

The City/Parish Government will also maintain, operate, and fund any ITS field equipment deployed within City/Parish Government right-of-way.

The City/Parish Government will continue to maintain and operate the Advanced Traffic Signal Control System within the City of Baton Rouge (both State and City owned signals) via the existing agreement between the City/Parish Government and LDOTD in which LDOTD provides funding to the City/Parish Government for operation and maintenance of State owned signals within the City of Baton Rouge. All planned Advanced Traffic Signal Control improvements in the "Near Term Deployment Plan" fall within the jurisdiction of this existing agreement. Some corridors slated for inclusion and upgrade into the Advanced Traffic Signal

Control Program in the "Mid Term Deployment Plan" are located outside of the jurisdiction of the existing operation and maintenance agreement. The existing operation and maintenance agreement between the City/Parish Government and LDOTD will be modified for inclusion of these Advanced Traffic Signal Systems prior to the implementation and integration of these systems.

The LDOTD will provide funding for the operation and maintenance of ITS field equipment deployed as part of the Baton Rouge ATMS within LDOTD right-of-way. The LDOTD will utilize a contract maintenance service provider for preventative maintenance, general maintenance repairs, parts and spare parts storage for ITS field deployed equipment within the LDOTD right-of-way including: ITS equipment and associated structures; environmental cabinet enclosures and controllers; the power distribution system and associated equipment not maintained by a private utility; and communication hubs, equipment, and any associated transmission system not maintained by a private utility. The LDOTD will also provide annual funding for power consumption of ITS field equipment within the LDOTD right-of-way and any communication leases required to operate ITS field deployed equipment.

The following is a listing of the preliminary estimated annual Operations and Maintenance costs by category consistent with staffing scenarios and operating philosophies documented in this document and consistent with the phasing shown in the ITS Strategic Deployment Plan.

PRELIMANARY ESTIMATE OF OPERATION AND MAINTENANCE COSTS FOR THE BATON ROUGE ATMS (20 YR HORIZON)

(in 1998 US Dollars)

Year	TMC Staffing *1	TMC Maintenance (Equipment Hardware and Software) *2	Field Equipment (Operation and Maintenance) *3
1999	0	0	0
2000	85,000	0	0
2001	255,000	30,000	40,000
2002	325,000	35,000	40,000
2003	395,000	80,000	162,500
2004	395,000	90,000	248,000
2005	395,000	90,000	248,000
2006	395,000	90,000	248,000
2007	395,000	110,000	360,000
2008	395,000	110,000	360,000
2009 thru 2017 (estimated range)	395,000 to 470,000	125,000 to 140,000	468,000 to 562,000

*1 Salary costs utilized are fully loaded including basic salary, overhead, overtime, benefits, etc.

*2 Includes maintenance of hardware, software, video projection devices, and general operating expenses such as office supplies and reproductions.

*3 Includes maintenance of ITS field equipment including: associate environmental enclosures, controls, structures; power distribution system and associated equipment; and communication HUB sites as well as equipment and transmission systems. Also includes cost of annual power usage and communication leases.

Note: Estimates do not include O & M costs for existing and/or legacy ITS Systems which are currently being operated and maintained by LDOTD and City and have existing dedicated funding sources.

APPENDIX A

Appendix A

Deployment of Arterials slated for advanced surface street control commensurate with the system design life by priority.

Priority 1

- Nicholson Drive from Roosevelt to E. McKinley - Two (2) signals.
- Nicholson Drive from N. Stadium to Lee/Brightside - Five (5) signals.
- Highland Road from Terrace to State Street - Six (6) signals.
- Highland Road from Chimes to S. Stadium - Five (5) signals.
- Highland Road from W. Parker to LSU Avenue - Two (2) signals.
- Highland Road from Staring to Gardere - Two (2) signals.
- Burbank from Boyd to Jennifer Jean - Two (2) signals. (Need to verify if Jennifer Jean improvements implemented.)
- Isolated Intersections:
  - Dalrymple Drive at State Street
  - Nicholson at Terrace
- Airline Highway (US 61/190) from Winbourne Avenue to Beechwood Drive - Eight (8) signals.
- Sherwood Forest from Coursey Boulevard to Old Hammond Highway - Eight (8) signals.
- College Drive from Concord Avenue to N. Foster Drive - Eight (8) signals.
- Isolated Intersections:
  - Greenwell Street at Silverleaf Avenue
  - Glen Oaks Drive at Silverleaf Avenue
  - Sherwood Forest at Goodwood Boulevard
  - Sharp Lane at Goodwood Boulevard
  - Sharp Lane at Old Hammond Highway
  - College Drive at Perkins Road
  - Lee Drive at Hyacinth Avenue
  - Perkins Road at Pollard Parkway
- Bluebonnet Road from Gail to Alselmo - Seven (7) signals.
- Essen Lane between I-10 and Perkins - Three (3) signals.
- Monterey from South Choctaw to Great Smokey - Three (3) signals.
- Seigen Lane from Industrial Plex to South Mall Drive.
- Airline Highway from East Industrial Drive to Florline Drive - Four (4) signals.
- Florida Boulevard from N. Foster Drive to Wooddale Boulevard - Seven (7) signals.
- Perkins Road from Siegen Lane to I-10 - Fifteen (15) signals.
- S. Acadian Throughway from Bawell Street to Morning Glory Avenue - Five (5) signals.

- Essen Lane from I-10 to Perkins Road - Three (3) signals. (Essen at Margaret Ann, Hennessy, and Picardy previously interconnected. Should consider including I-10 East and I-10 West ramp signals.)

- Perkins Road at Broussard Street - One (1) signal. Perkins Road at Park Boulevard - One (1) signal.

Priority 2

- Florida Boulevard from Oak Villa to the East Parish Line - Twelve (12) signals.
- Choctaw Drive from Choctaw Street to Greenwell Springs Road - Twelve (12) signals.
- Choctaw Drive from Airway Drive to Sherwood Forest Boulevard - Four (3) signals.
- Goodwood Boulevard from Lobdell Avenue to Airline Highway - Five (5) signals.
- N. Foster Drive from Claycut Avenue to Airline Highway - Eleven (11) signals.
- Government Street from I-110 to East Airport - Seventeen (17) signals.
- S. Acadian Throughway from Bawell Street to North Street - Six (6) signals.
- Airline Highway from Vine Street to Cedarcrest Drive - Ten (10) signals.

Priority 3

- Jefferson Highway (LA 73) from Government Street to Airline Highway (US 61) – Ten (10) signals.
- Essen Lane (LA 3064) from I-10 to Jefferson Highway (LA 73) – Three (3) signals.
- Plank Road (LA 67) from North Blvd. (Bus. 61/US 190 to Harding Blvd.) – Twenty (20) signals.
- Harding Boulevard (LA 408) from US 61 to I-110 – Three (3) signals.
- Range Road (LA 3002) from I-12 to US 190 (include intersection at railroad) – Five (5) signals.
- LA 415 from I-10 to US 190 – Two (2) signals.
- LA 1 from I-10 to US 190 – Three (3) signals.

Priority 4

- Old Hammond Highway (LA 426) from Jefferson Highway (LA 426) to O'Neal Lane (LA 3245) – Five (5) signals.
- Airline Highway (US 61) from Jefferson Highway (LA 73) to Highland Road (LA 72) – Five (5) signals.
- Highland Road (LA 42) from I-10 to Perkins/Barringer Forman – Three (3) signals.
- O'Neal Lane (LA 3245) from Harrell's Ferry Road to Old Hammond Highway (LA 426) – Nine (9) signals.
- Millerville Road from Harrell's Ferry Road to Old Hammond Highway (LA 426) - Three (3) signals.

- Florida Blvd. (Bus. US 61/US 190) from I-110 to North Foster – Seven (7) signals.
- LA 19 from Scenic Highway (LA 61) to Baker Blvd. – Eleven (11) signals.

Priority 5

- Burbank Drive from Highland Road (LA 42) to Jennifer Jean - Five (5) signals.
- Harrell's Ferry Road from Intersection with Jones Creek Road - One (1) signal.
- Scenic Highway (US 61) from I-110 to Thomas Road (LA 423) - Fifteen (15) signals.
- Mickens Road from Hooper Road to Joor Road - Three (3) signals.
- Greenwell Springs Road from Ardenwood Drive to Sherwood Forest - Ten (10) signals.
- Lee Drive from Highland Road to Hyacinth Avenue - Two (2) signals.
- Staring Lane from Intersection with Hyacinth Avenue - One (1) signal.
- Bluebonnet Road from Intersection with Highland Road - One (1) signal.
- Chippewa Road from I-110 to Nicholson - Ten (10) signals.
- Plank Road from Halsey Street to Kent Drive - Five (5) signals.

APPENDIX B

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
P.O. Box 94245
Baton Rouge, Louisiana 70804-9245

M. J. "MIKE" FOSTER, JR.
GOVERNOR

FRANK M. DENTON
SECRETARY

October 9, 1998

Mr. Jerry Klier, P.E.
Deputy Director
Department of Public Works
P O Box 1471
Baton Rouge, LA 70821

Re: **Original Agreement**
State Project Nos. 742-17-0119, 742-17-0120 and 742-17-0121
F.A.P. Nos. CM-HP-MISC(275) and CM-MISC(275)
East Baton Rouge Parish No. 97-MS-CP-0040
Advanced Traffic Management Center
and Emergency Operations Center
East Baton Rouge Parish

Dear Mr. Klier:

Enclosed is the City's fully executed agreement with the Department dated October 9, 1998. This agreement provides for the funding of the referenced project. Through a copy of this letter, the contract is being transmitted internally to those indicated below.

Very truly yours,

Jose D. Bacci, P.E.
Consultant Contract
Services Administrator

JDB:PBB
Attachments
pc: w/att.
Financial Services Section
Mr. Gordon Nelson
Mr. Steve Cumbaa
Mr. Oscar Cruz
Consultant Contract Services Files
Project Control Files
Mr. Carl Ellis
Mr. Murphy Oufnac
FHWA

RECEIVED
OCT 14 1998
DIRECTOR, D.P.W.

DEPARTMENT'S COPY

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

AGREEMENT
STATE PROJECT NOS. 742-17-0119, 742-17-0120 AND 742-17-0121
FEDERAL AID PROJECT NOS. CM-HP-MISC(275) AND CM-MISC(275)
EAST BATON ROUGE PARISH PROJECT NO. 97-MS-CP-0040
ADVANCED TRAFFIC MANAGEMENT CENTER
AND
EMERGENCY OPERATIONS CENTER
EAST BATON ROUGE PARISH

THIS AGREEMENT, made and executed in three (3) original copies on this 9th day of October, 1998, by and between the Department of Transportation and Development, hereinafter referred to as "DOTD", and the City of Baton Rouge/Parish of East Baton Rouge, a political subdivision of the State of Louisiana, hereinafter referred to as "Grantee";

WITNESSETH: That;

WHEREAS, under the provisions of Title 23, United States Code, "Highways", as amended, funds have been appropriated under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) to finance projects under the Congestion Mitigation and Air Quality (CMAQ) Program and under the Transportation Equitable Act for the 21st Century (TEA 21) which are under the direct administration of the DOTD; and

WHEREAS, the Grantee has requested an appropriation of funds to finance a portion of the project as described herein; and

WHEREAS, the project is part of a transportation improvements program serving the Baton Rouge Metropolitan Area and has been included in the local Metropolitan Planning (MPO) Transportation Improvement Program (TIP), as required by 23 CFR 450.324; and

WHEREAS, the DOTD is agreeable to the implementation of this Project and desires to cooperate with the Grantee as hereinafter provided:

NOW, THEREFORE, in consideration of the premises and mutual dependent covenants herein contained, the parties hereto agree as follows:

ARTICLE I - PROJECT DESCRIPTION

The improvement that is to be undertaken under this project will consist generally of building an advanced traffic management center and emergency operations center. All traffic control incident management and emergency functions for East Baton Rouge Parish will be housed in this specifically constructed facility. The facility will be located on Harding Boulevard (LA 408) approximately one-half mile east of Interstate Highway 110.

For purposes of identification and record keeping, State and Federal Project Numbers have been assigned to this project as follows:

For clearing and grubbing services, State Project No. 742-17-0119 and Federal-Aid Project No. CM-MISC(275) have been assigned to the federal participation portion and State Project No. 742-17-0121 for non-participating funds. All correspondence regarding clearing and grubbing shall be identified with these project numbers.

For all services relating to the construction of the facility, including construction, engineering/architectural inspection and testing services, State Project No. 742-17-0120 and Federal Project No. CM-HP-MISC(275) and CM-MISC(275) have been assigned. All correspondence regarding construction, including construction plans shall be identified with these project numbers.

All progress reports, invoices, etc. incurred in the performance of these services shall be identified with these project numbers.

ARTICLE II - FUNDING

Except for services hereinafter specifically listed to be furnished at the DOTD's expense or at the Grantee's expense, as the case may be, the cost of this project will be a joint participation between the Grantee and the Federal Highway Administration, hereinafter "FHWA". At the time of authorization the FHWA will participate at an 80% level in 30% of the clearing and grubbing, facility construction, architectural/engineering, testing and inspection services. The FHWA will also contribute an additional maximum amount of $5,400,000 which represents an 80% participation rate in the allowable remaining project costs. Total FHWA participation from all funding sources will not exceed 80% of allowable (participating) total costs incurred after FHWA authorization. The Grantee will fund all remaining and non-participating project costs. The Grantee does, however, reserve the right to incorporate items of work into the construction contract not eligible for Federal-Aid participation if it so desires. Funds will be disbursed as provided in Article VII.

The Grantee is hereby forewarned that no contractual obligations or expenditures of funds will be incurred until the DOTD and the Grantee are in receipt of the Federal Highway Administration authorization (FHWA form 1240) and the DOTD formally notifies the Grantee that it may incur contractual obligation and fund expenditures.

The cost of all services performed for the Grantee by the DOTD at the specific request of the Grantee will be determined on the basis of the DOTD's actual cost plus overhead including payroll additives. Payment for such services shall be made in advance by the Grantee based on a reasonable estimate prepared by the DOTD. Overruns and/or underruns in the cost of such services will be determined after completion of the services rendered and the proper party will be reimbursed accordingly. Services performed by the DOTD will be eligible for reimbursement by the FHWA in the appropriate ratio in effect at the Time of authorization.

ARTICLE III - CONSTRUCTION PLANS

Plans, specifications, and contract documents for the proposed facility shall be prepared by the Grantee or by a qualified architectural and/or engineering firm employed by the Grantee at no expense to the DOTD and Federal Highway Administration. Plans and specifications for the facility building shall as a minimum conform to Title 8 of the Code of Ordinances for the City of Baton Rouge, Louisiana and the Parish of East Baton Rouge, Louisiana. The plans, specifications, and contract documents shall be approved by the DOTD and Federal Highway Administration.

ARTICLE IV - RECEIPT OF BIDS

For State Project Nos. 742-17-0119 and 742-17-0221, the DOTD will, at its expense and at the proper time, prepare construction proposals based on Louisiana Standard Specifications for Roads and Bridges, 1992 edition, as amended to comply with the DOTD's current practices, advertise for and receive bids for the work in accordance with the DOTD's normal requirements. All such bids will be properly tabulated, extended and summarized to determine the official low bidder. The DOTD will then submit to the Grantee copies of the official bid tabulations for their information and comments or approval while its Review Committee will concurrently analyze the bids for the DOTD. The award of contract, which by law must be made within sixty (60) days following the receipt of bids, will be made by the DOTD on behalf of the Grantee following the favorable recommendation of award by the Review Committee and concurrence by the Federal Highway Administration and the Grantee.

For State Project No. 742-17-0220, unless otherwise amended by the DOTD, the grantee will, at its expense and at the proper time, prepare the construction plans, specifications and contract documents in accordance with the American Institute of Architects, requirements for federal projects, utilizing the Construction Specifications Institute format. The DOTD will then advertise for and receive bids for the work in accordance with the DOTD's normal requirements. The cost incurred by the grantee for the reproduction of plans, specifications, and contract documents, will be reimbursed in accordance with Article VII of this agreement.

Construction contracts will be prepared by the DOTD after the award of contract and will be transmitted to the Grantee for its further handling toward execution. The Grantee will be responsible for construction contract recordation. The DOTD will, at the proper time, inform the Grantee in writing to issue to the Contractor an official "Notice to Proceed" with construction.

ARTICLE V - CONSTRUCTION

The Grantee or its consultant will provide technical administration and inspection during the project construction; however, in the event a consultant provides this service for the Grantee it will be performed under the direct supervision of a full time employee of the Grantee who will have charge and control of the project at all times.

The DOTD will assign a project engineer from its District Office in Baton Rouge to serve as a construction coordinator for the DOTD during project construction. The construction coordinator will make intermittent trips to the construction site to insure that the construction contractor is following established construction procedures and that applicable Federal and State requirements are being enforced. The construction coordinator will advise the Project Engineer of any discrepancies noted and, if necessary, will direct that appropriate remedial action be taken. Failure to comply with such directives will result in the withholding of funds by DOTD until corrective measures are taken by the Grantee.

Except where a deviation has been mutually agreed to in writing by both the DOTD and the Grantee, the following specific requirements shall apply.

1. When it is stipulated in Louisiana Standard Specifications for Roads and Bridges that approval by the engineer or the DOTD is required for equipment and/or construction procedures, such approval must be obtained through the DOTD Construction Section. All DOTD policies and procedures for obtaining such approval shall be followed.

2. For all three (3) projects all construction inspections personnel utilized by the Grantee and/or the Grantee's consultant must meet the same qualifications required of DOTD construction personnel. When certification in a specific area is required, these personnel must meet the certification requirements of DOTD. Additionally, the construction inspection personnel for the building S.P. No. 742-17-0220 shall meet the certification requirements of the Southern Building Code Congress International.

3. All construction procedures must be in accordance with DOTD guidelines and policies established by the Construction Manual, Chapter IX, the Engineering Directives and Standard Manual, and any applicable memoranda. These documents will be made available to the Grantee or its consultant by DOTD.

4. All documentation of pay quantities must conform to the requirements of DOTD as outlined in the Construction Manual, Chapter VI. This manual will be made available to the Grantee or its consultant by DOTD.

5. All materials to be tested shall be sampled in accordance with the Department's Sampling Manual. All material testing other than those test normally run by project personnel on the job site shall be tested by the Department's District or Central Laboratory.

The consultant and/or the Grantee shall be required to comply with all parts of this section while performing duties as project engineer.

ARTICLE VI - SUBCONTRACTING

Any subcontracting performed under this project either by consulting engineers or architects engaged by the Grantee or the construction contractor must have the prior written consent of the Grantee. In the event that the consultant or the contractor elects to sublet any of the services required under this contract, it must take affirmative steps to utilize small business and disadvantaged/women-owned business as sources of supplies, equipment, construction, and services. Affirmative steps shall include the following:

(a) Including qualified small and disadvantaged/women businesses on solicitation lists.

(b) Assuring that small and disadvantaged/women businesses are solicited whenever they are potential sources.

(c) When economically feasible, dividing total requirements into smaller tasks or quantities so as to permit maximum small and disadvantaged/women business participation.

(d) Where the requirement permits, establishing delivery schedules which will encourage participation by small and disadvantaged/women business.

(e) Using the services and assistance of the Small Business Administration, the Office of Disadvantaged Business Enterprise of the Department of Commerce and the Community Services Administration as required.

Also, the Contractor is encouraged to procure goods and services from labor surplus areas.

ARTICLE VII - COST REIMBURSEMENTS

The DOTD will reimburse the Grantee monthly a percentage of the costs of clearing and grubbing, construction and construction architectural, engineering and/or testing services based upon the limitations as outlined in Article II. The Grantee shall render invoices monthly for reimbursement, which invoices shall be certified as correct by the proper designated official of the Grantee. All such charges shall be subject to verification, adjustment and/or settlement by the DOTD's Audit Officer.

In the event the Grantee elects to utilize consulting engineers and/or architects to perform construction engineering or architectural services, they shall be approved by DOTD prior to their utilization under this project.

When the final costs of clearing and grubbing, construction and construction architectural, engineering and/or testing services, have been determined, adjustments will be made so that the amount of participation in these items will not exceed the percentages outlined in Article II. Before final payment is recommended by DOTD, all documentation of pay quantities shall conform to DOTD policies and procedures. The Grantee acknowledges, however, that the FHWA will not participate in the cost of those items not constructed in accordance with the approved plans and specifications and in this event the Grantee will be obligated to assume full financial responsibility. The Grantee shall also submit all final billings for all phases of work within one year after the completion of final acceptance of the project. Failure to submit these billings within the specified one year period shall result in the project being closed on previously billed amounts and any unbilled cost shall be the responsibility of the Grantee. Federal reimbursement for a portion of the costs will be yearly as federal funds become available for this project.

The Grantee shall reimburse the DOTD any and all amounts which may be cited by the FHWA or DOTD due to the Grantee's noncompliance with Federal/State laws and/or regulations. The cited amounts reimbursed by the Grantee will be returned to the Grantee upon clearance of the citation(s).

Should the Grantee fail to reimburse the DOTD any and all cited amounts within a ninety (90) day period after notification, all future payment request(s) from the Grantee will be held until the cited amount is exceeded at which time only the amount over and above the cited amount(s) will be released for payment. Additionally, no new projects will be approved until such time as the cited amount is reimbursed to the DOTD.

The participation by the DOTD and the FHWA in the project shall in no way be construed to make the DOTD or the FHWA a party to the contract between the Grantee and its engineers, architects or contractors.

ARTICLE VIII - COST RECORDS

The Grantee and all others employed by the Grantee in connection with this project shall maintain all books, documents, papers, accounting records and other evidence pertaining to cost incurred relative to this project and shall keep such material available at their respective offices at all reasonable times during the contract period and for three (3) years from the date of final payment under the project, for inspection by the DOTD and/or Legislative Auditor, the FHWA or any authorized representative of the Federal Government under State and Federal Regulations effective as of the date of this contract and copies thereof shall be furnished if requested.

ARTICLE IX - CANCELLATION

The terms of this agreement shall be binding upon the parties hereto until the work has been completed and accepted and all payments required to be made to the Grantee have been made; but this agreement may be terminated under any or all of the following conditions:

1. By mutual agreement and consent of the parties hereto.

2. By the Grantee should it desire to cancel the project prior to the receipt of bids, provided any cost that has been incurred for the preparation of plans, specifications and contract documents is not eligible for reimbursement by the DOTD or the FHWA.

3. By the DOTD due to the withdrawal of State or Federal funding for the project.

ARTICLE X - PROJECT RESPONSIBILITY

The DOTD, its officers, engineers and employees will not be required to supervise or perform such other services in connection with the development of this project as specifically set forth herein; however, the Grantee will assume full responsibility for the project development and will save harmless the DOTD against any loss or damage of any kind incident to or occasioned by deeds undertaken in pursuance of this agreement.

ARTICLE XI - FINAL INSPECTION AND MAINTENANCE

Upon completion and final acceptance of the project construction, copy of which acceptance shall be furnished to the DOTD by the Grantee, the Grantee shall assume the maintenance of the improvement at its expense and in a manner satisfactory to the DOTD and/or the FHWA. The contractor's final acceptance will be recorded by the Grantee. Before making the final inspection, the DOTD's District Administrator shall be notified so that he may have a representative present for such inspection.

ARTICLE XII - OPERATIONAL RESPONSIBILITY

The Grantee will be responsible for the complete operation of the facility, including the Traffic Management Center. Further, DOTD and FHWA agrees that the Grantee shall have full and complete authority to operate and control all traffic devices on all federal, state and local routes. However, DOTD reserves the right to monitor all traffic operations and in emergency situations, retains the override authority on all federal and state routes.

ARTICLE XIII - CIVIL RIGHTS

The Grantee agrees that the project will be developed in full, in accordance with the principles and intents contained in the DOTD's latest Title VI Plan (Phase I) and that the same or closely related procedures providing for involvement of the Grantee designated civil rights specialist in appropriate key stages of project development as identified in the aforementioned Title VI Plan, will be followed.

Further, the Grantee agrees that its own employment policies and practices will afford fair and nondiscriminatory employment opportunities to all employees and applicants for employment and that a viable affirmative action program is maintained in the interest of increasing employment opportunities for minorities, women and other disadvantaged persons. It is understood that the Grantee, as a recipient of federal financial assistance under this agreement, is subject to monitoring and review of its civil rights activities by the DOTD and agrees to cooperate with DOTD officials in the achievement of civil rights objectives prescribed in the agreement and in any contracts resulting herefrom.

ARTICLE XIV - PUBLIC LIABILITY

The Grantee shall indemnify and save harmless the DOTD against any and all claims, demands, suits and judgements for sums of money allegedly due to any party for loss of life or injury or damage to persons or property growing out of, resulting from, or by reason of, any negligent act or omission, operation or work of the Grantee, its agents, servants or employees while engaged upon or in connection with the services required or performed by the Grantee or resulting from the ownership, possession or control of the improvement during its life.

ARTICLE XV- FEDERAL PROVISIONS

The provisions set forth in the attached "Agreement Provisions" (Federal Form PR-2) which will be formally entered into between the DOTD and the Federal Highway Administration following the execution of this agreement shall be made an integral part of this agreement by reference and adhered to by the Grantee.

The Grantee agrees that as a condition to payment of the Federal funds obligated, it accepts and will comply with the applicable provisions set forth in 23 CFR, Part 630, Subpart C, Appendix A, which is incorporated herein by reference.

IN WITNESS WHEREOF, the parties hereto have caused these presents to be executed by their respective officers thereunto duly authorized as of the day and year first above written.

WITNESSES:

(Witness for First Party)

(Witness for First Party)

(Witness for Second Party)

(Witness for Second Party)

STATE OF LOUISIANA
CITY OF BATON ROUGE/
PARISH OF EAST BATON ROUGE

BY:

TOM ED McHUGH
Typed or Printed Name

TITLE: MAYOR-PRESIDENT

72-6000137

Federal Identification Number

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION
AND DEVELOPMENT

BY:
Secretary

RECOMMENDED FOR
APPROVAL BY:
Chief Engineer

APPROVED AS TO FORM

CONSULTANT CONTRACT
SERVICES SECTION

Approved as to Form

Parish Attorney's Office

TO BE COMPLETED BY FHWA	U.S. Department of Transportation Federal Highway Administration — FEDERAL-AID PROJECT AGREEMENT	STATE Louisiana
		PARISH
		PROJECT NO.

The State, through its Highway Agency, having complied, or hereby agreeing to comply, with the applicable terms and conditions set forth in (1) Title 23, U.S. Code, Highways, (2) the Regulations issued pursuant thereto and, (3) the policies and procedures promulgated by the Federal Highway Administrator relative to the above designated project, and the Federal Highway Administration having authorized certain work to proceed as evidenced by the date entered opposite the specific item of work, Federal funds are obligated for the project not to exceed the amount shown herein, the balance of the estimated total cost being an obligation of the State. Such obligation of Federal funds extends only to project costs incurred by the State after the Federal Highway Administration authorization to proceed with the project involving such costs.

PROJECT TERMINI

PROJECT CLASSIFICATION OR PHASE OF WORK	EFFECTIVE DATE OF AUTHORIZATION	APPROXIMATE LENGTH (MILES)
HIGHWAY PLANNING AND RESEARCH (HP & R)		
PRELIMINARY ENGINEERING		
RIGHTS-OF-WAY		
CONSTRUCTION		
OTHER (SPECIFY)		

FUNDS

ESTIMATED TOTAL COST OF PROJECT	FEDERAL FUNDS
$	$

The State further stipulates that as a condition to payment of the Federal funds obligated, it accepts and will comply with the applicable provisions set forth on the following pages.

LA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT
(Official name of Highway Agency)

By ______________________

(Title)

By ______________________

(Title)

By ______________________

(Title)

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

By ______________________
(Division Administrator)

Date executed by Division Administrator ______________________

AGREEMENT PROVISIONS

1. RESPONSIBILITY FOR WORK

a. Except for projects constructed under Certification Acceptance procedures, the State highway agency will perform the work, or cause it to be performed, in compliance with the approved plans and specifications or project proposal which, by reference, are made a part hereof.

b. With regard to projects performed under Certification Acceptance procedures, the State highway agency will perform the work, or cause it to be performed, in accordance with the terms of its approved Certification, or exceptions thereto as may have been approved by the Federal Highway Administration.

2. HIGHWAY PLANNING AND RESEARCH (HP&R) PROJECT. The State highway agency will (a) conduct or cause to be conducted, under its direct control, engineering and economic investigations of projects for future construction, together with highway research necessary in connection therewith, pursuant to the work program approved by the Federal Highway Administration and (b) prepare reports suitable for publication of the result of such investigations and research, but no report will be published without the prior approval of the Federal Highway Administration.

. PROJECT FOR ACQUISITION OF RIGHTS-OF-WAY. n the event that actual construction of a road on this right-of-way is not undertaken by the close of the tenth fiscal ear following the fiscal year in which this agreement is executed, the State highway agency will repay to the Federal ighway Administration the sum or sums of Federal funds paid the highway agency under the terms of this agreement.

PRELIMINARY ENGINEERING PROJECTS. In the ent that right-of-way acquisition for, or actual construction the road for which this preliminary engineering is underken is not started by the close of the fifth fiscal year followg the fiscal year in which this agreement is executed, the ate highway agency will repay to the Federal Highway dministration the sum or sums of Federal funds paid to the ghway agency under the terms of this agreement.

INTERSTATE SYSTEM PROJECT.

The State highway agency will not add or permit to be ded, without the prior approval of the Federal Highway ministration any points of access to, or exit from, the project addition to those approved in the plans and specifications for project.

The State highway agency will not permit automotive vice stations, or other commercial establishments for serving tor vehicle users, to be constructed or located on the right-of-y of the interstate system.

The State highway agency will not after June 30, 1968, mit the construction of any portion of the Interstate Route which this project is located, including spurs and loops, as a road without the written concurrence of the Secretary of insportation or his officially designated representative. The n "toll road" does not include toll bridges or toll tunnels.

PROJECT FOR CONSTRUCTION IN ADVANCE OF PORTIONMENT.

This project authorized pursuant to 23 U.S.C. 115 as nded, will be subject to all procedures and requirements, conform to the standards applicable to projects on the m on which located, financed with the aid of Federal funds.

b. No present or immediate obligation of Federal funds is created by this agreement, its purpose and intent being to provide that, upon application by the State highway agency, and approval thereof by the Federal Highway Administration, any Federal-aid funds of the class designated by the project number prefix, apportioned or allocated to the State under 23 U.S.C. 103(e)(4), 104, or 144 subsequent to the date of this agreement, may be used to reimburse the State for the Federal share of the cost of work done on the project.

7. STAGE CONSTRUCTION. The State highway agency agrees that all stages of construction necessary to provide the initially planned complete facility, within the limits of this project, will conform to at least the minimum values set by approved AASHTO design standards applicable to this class of highways, even though such additional work is financed without Federal-aid participation.

8. BOND ISSUE PROJECT. Construction, inspection and maintenance of the project will be accomplished in the same manner as for regular Federal-aid projects. No present or immediate obligation is created by this Agreement against Federal funds, its purpose and intent being to provide aid to the State, as authorized by 23 U.S.C. 122, for retiring maturities of the principal indebtedness of the bonds referred to below. When the State requests Federal reimbursement to aid in the retirement of such bonds, the request will be supported by the appropriate certification required by 23 CFR Part 140, Subpart F, and Volume 1, Chapter 4, Section 8 of the Federal-Aid Highway Program Manual, and payment of the authorized Federal share will be made from appropriate funds available. If in any year there is no obligated balance of any apportioned Federal funds available from which payments hereunder may be made, there will be no obligation on the part of the Federal Government on account of bond maturities for that year. Funds available to the highway agency for this project are the proceeds of bonds issued by the governmental unit indicated on the attached tabulation, pursuant to the authority and in the amounts by date of issue and beginning date of maturities set forth therein.

9. SPECIAL HIGHWAY PLANNING AND RESEARCH PROJECT. The State highway agency hereby authorizes the Federal Highway Administration to charge the State's pro rata share of costs incurred against funds apportioned to the State under 23 U.S.C. 307 (c), as amended. In the event a project is financed with both Federal-aid funds and State matching funds, the State agrees to advance to The Federal Highway Administration the State matching funds for its share of the estimated cost. For a National Pooled Fund study, the State hereby assigns its responsibility for the work to the Federal Highway Administration. For an Intra-Regional Cooperative Study, the State hereby assigns its responsibility for the work to the lead State for the study.

10. PARKING REGULATION AND TRAFFIC CONTROL. The State highway agency will not permit any changes to be made in the provisions for parking regulations and traffic control as contained in the agreement between the State and the local unit of Government referred to in the paragraph on "Additional Provisions," without the prior approval of the Federal Highway Administration, unless the State determines, and the Division Administrator concurs, that the local unit of Government has a functioning traffic engineering unit with the demonstrated ability to apply and maintain sound traffic operations and control.

11. SIGNING AND MARKING. The State highway agency will not install, or permit to be installed, any signs, signals, or markings not in conformance with the standards approved by the Federal Highway Administrator pursuant to 23 U.S.C. 109(d) or the State's Certificate as applicable.

12. MAINTENANCE. The State highway agency will maintain, or by formal agreement with appropriate officials of a county or municipal government cause to be maintained, the project covered by this agreement.

13. LIQUIDATED DAMAGES. The State highway agency agrees that on Federal-aid highway construction projects not under Certification Acceptance the provisions of 23 CFR Part 630, Subpart C and Volume 6, Chapter 3, Section 1 of the Federal-Aid Highway Program Manual, as supplemented, relative to the basis of Federal participation in the project cost shall be applicable in the event the contractor fails to complete the contract within the contract time.

14. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT (APPLICABLE TO CONTRACTS AND SUBCONTRACTS WHICH EXCEED $100,000).

a. The State highway agency stipulates that any facility to be utilized in performance under or to benefit from this agreement is not listed on the Environmental Protection Agency (EPA) List of Violating Facilities issued pursuant to the requirements of the Clean Air Act, as amended, and the Federal Water Pollution Control Act, as amended.

b. The State highway agency agrees to comply with all of the requirements of section 114 of the Clean Air Act and section 308 of the Federal Water Pollution Control Act, and all regulations and guidelines issued thereunder.

c. The State highway agency stipulates that as a condition of Federal aid pursuant to this agreement it shall notify the Federal Highway Administration of the receipt of any advice indicating that a facility to be utilized in performance under or to benefit from this agreement is under consideration to be listed on the EPA List of Violating Facilities.

d. The State highway department agrees that it will include or cause to be included in any Federal-aid to highways agreement with a political subdivision of the State which exceeds $100,000 the criteria and requirements in these subparagraphs a. through d.

15. EQUAL OPPORTUNITY. The State highway agency hereby agrees that it will incorporate or cause to be incorporated into any contract for construction work, or modification thereof, as defined in the rules and regulations of the Secretary of Labor at 41 CFR Chapter 60, which is paid for in whole or in part with funds obtained from the Federal Government or borrowed on the credit of the Federal Government pursuant to a grant, contract, loan, insurance or guarantee, or undertaken pursuant to any Federal program involving such grant, contract, loan, insurance or guarantee, the following equal opportunity clause:

"During the performance of this contract, the contractor agrees as follows:

a. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising; layoffs or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the State highway agency setting forth the provisions of this nondiscrimination clause.

b. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.

c. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided by the State highway agency advising the said labor union or workers' representative of the contractor's commitments under Section 202 of the Executive Order 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

d. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations and relevant orders of the Secretary of Labor.

e. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by the rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records and accounts by the Federal Highway Administration and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations and orders.

f. In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations or orders, this contract may be canceled, terminated or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or Federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation or order of the Secretary of Labor, or as otherwise provided by law.

g. The contractor will include the provisions of Section 202 of Executive Order 11246 of September 24, 1965, in every subcontract or purchase order unless exempted by rules, regulations or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the State highway agency or the Federal Highway Administration may direct as a means of enforcing such provisions including sanctions for noncompliance; *Provided, however*, that in the event a contractor becomes involved in, or is threatened with litigation with a subcontractor or vendor as a result of such direction by the Administration, the contractor may request the United States to enter in such litigation to protect the interests of the United States."

The State highway agency further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work: Provided, that if the applicant so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.

The State highway agency also agrees:
(1) To assist and cooperate actively with the Federal Highway Administration and the Secretary of Labor in obtaining the compliance of contractors and subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor.
(2) To furnish the Federal Highway Administration and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the Federal Highway Administration in the discharge of its primary responsibility for securing compliance.
(3) To refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order.
(4) To carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and subcontractors by the Federal Highway Administration or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order.
In addition, the State highway agency agrees that if it fails or refuses to comply with these undertakings, the Federal Highway Administration may take any or all of the following actions:
(a) Cancel, terminate, or suspend this agreement in whole or in part;
(b) Refrain from extending any further assistance to the State highway agency under the program with respect to which the failure or refusal occurred until satisfactory assurance of future compliance has been received from the State highway agency; and
(c) Refer the case to the Department of Justice for appropriate legal proceedings.

16. NONDISCRIMINATION. The State highway agency (SHA) hereby agrees that it will comply with Title VI of the 1964 Civil Rights Act and related statutes and implementing regulations to the end that no person shall on the grounds of race, color, national origin, handicap, age, sex, or religion be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under the project covered by this agreement and, further, the SHA agrees that:
a. It will insert the nondiscrimination notice required by the Standard Department of Transportation (DOT) Title VI Assurance (DOT Order 1050.2) in all solicitations for bids for work or material, and, in adapted form, in all proposals for negotiated agreements.
b. It will insert the clauses in Appendixes A, B, or C of DOT Order 1050.2, as appropriate, in all contracts, deeds transferring real property, structures, or improvements thereon or interest therein (as a covenant running with the land) and in future deeds, leases, permits, licenses, and similar agreements, related to this project, entered into by the SHA with other parties.
c. It will comply with, and cooperate with, FHWA in ensuring compliance with the terms of the standard Title VI Assurance, the act and related statutes, and implementing regulations.

17. MINORITY BUSINESS ENTERPRISES (MBE's)
a. The State highway agency hereby agrees to the following statements and agrees that these statements shall be included in all subsequent agreements between the recipient and any subrecipient and in all subsequent DOT-assisted contracts between recipients or subrecipients and any contractor:
(1) "Policy. It is the policy of the Department of Transportation that minority business enterprises (MBE's), as they are defined in 49 CFR Part 23 [for the purposes of 49 CFR Part 23, Subpart D, MBE's refer to disadvantaged business enterprises (DBE's); for the purposes of other subparts of Part 23, MBE's include women's business enterprises (WBE's)], shall have the maximum opportunity to participate in the performance of contracts financed in whole or in part with Federal funds under this agreement. Consequently, all applicable requirements of 49 CFR Part 23 apply to this agreement.
(2) "Obligation. The recipient or its contractor agrees to ensure that MBE's, as defined in 49 CFR Part 23, have the maximum opportunity to participate in the performance of contracts and subcontracts financed in whole or in part with Federal funds provided under this agreement. In this regard, all recipients or contractors shall take all necessary and reasonable steps in accordance with the applicable section of 49 CFR Part 23 to ensure that MBE's have the maximum opportunity to compete for and perform contracts. Recipients and their contractors shall not discriminate on the basis of race, color, national origin, handicap, religion, age, or sex, as provided in Federal and State law, in the award and performance of DOT-assisted contracts."
b. If, as a condition of assistance, the recipient has submitted and the Department has approved an MBE affirmative action program which the recipient agrees to carry out, this program is incorporated into this financial assistance agreement by reference. This program shall be treated as a legal obligation and failure to carry out its terms shall be treated as a violation of this financial assistance agreement. Upon notification to the recipient of its failure to carry out the approved program, the Department shall impose such sanctions as are noted in 49 CFR Part 23, Subparts D or E, which sanctions may include termination of the agreement or other measures that may affect the ability of the recipient to obtain future DOT financial assistance.

18. BICYCLE TRANSPORTATION AND PEDESTRIAN WALKWAYS. No motorized vehicles shall be permitted on bikeways or walkways authorized under this project except for maintenance purposes and, when snow conditions and State or local regulations permit, snowmobiles.

19. MODIFIED OR TERMINATED HIGHWAY PROJECTS. For certain projects described in 23 CFR Part 480 or as prescribed in other parts of Title 23, Code of Federal Regulations, the payback provisions found in these parts shall supersede provisions 3 and 4 of this agreement.

20. ENVIRONMENTAL IMPACT MITIGATION FEATURES. The State highway agency shall ensure that the project is constructed in accordance with and incorporates all committed environmental impact mitigation measures listed in approved environmental documents unless the State requests and receives written Federal Highway Administration approval to modify or delete such mitigation features.

ADDITIONAL PROVISIONS

Any real property acquired for this project determined to be excess to present of future programs needs will be disposed of in accordance with 49 CFR 18 and governing FHWA requirement.

ADOPTED
METROPOLITAN COUNCIL

SEP 09 1998

Brian Mayer
COUNCIL ADMINISTRATOR/TREASURER

864

RESOLUTION 38972

AUTHORIZING THE MAYOR-PRESIDENT TO EXECUTE AN AGREEMENT BETWEEN THE CITY OF BATON ROUGE/PARISH OF EAST BATON ROUGE AND THE LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT FOR THE ADVANCED TRAFFIC MANAGEMENT CENTER AND EMERGENCY OPERATIONS CENTER, BEING STATE PROJECT NOS. 742-17-0119, 742-17-0220 & 742-17-0221, FEDERAL AID PROJECT NO. CM-HP-MISC(275), CITY/PARISH PROJECT NO. 97-MS-CP-0040.

BE IT RESOLVED by the Metropolitan Council of the Parish of East Baton Rouge and City of Baton Rouge that:

Section 1. The Mayor-President is hereby authorized to execute an agreement between the City of Baton Rouge/Parish of East Baton Rouge and the Louisiana Department of Transportation and Development for the Advanced Traffic Management Center and Emergency Operations Center, being State Project Nos. 742-17-0119, 742-17-0220 & 742-17-0221, Federal Aid Project No. CM-HP-MISC(275), City/Parish Project No. 97-MS-CP-0040.

Section 2. Said agreement shall be approved by the Office of the Parish Attorney.

CERTIFIED
A TRUE COPY

SEP 11 1998

Brian Mayer
COUNCIL ADMINISTRATOR

ATTACHMENT I

MEMORANDUM OF UNDERSTANDING

FOR

STATE PROJECT NUMBER: 700-17-0161

ADVANCED TRAFFIC MANAGEMENT COMMUNICATIONS BUILDING

By and Among

THE CITY OF BATON ROUGE/EAST BATON ROUGE PARISH
and
THE LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
and
THE U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

It is understood and agreed as follows:

1. Based on the proposed square footage requirements for traffic control systems and traffic related functions of other systems, 30% of the cost of the building is eligible for assistance through the Federal Highway Administration (FHWA) and Louisiana Department of Transportation and Development (LDOTD) using appropriate Federal-aid funds, limited to 80% of that cost.

2. The required 20% match for the Federal-aid share will be provided by the City of Baton Rouge-Parish of East Baton Rouge.

3. The City/Parish is paying for the design of the facility.

4. The City/Parish will operate and maintain the facility and the traffic control systems, as will be further defined in the Implementation Plan.

5. LDOTD will assign a coordinator to monitor the design and development of the facility.

6. FHWA will assign a coordinator to monitor the design and development of the facility.

7. FHWA will be the lead agency for the Environmental Clearance.

8. The City/Parish will let the project for construction following all LDOTD and FHWA procedures as outlined by these agencies. LDOTD and FHWA will review all documents for compliance.

9. Federal-aid construction authorization for the building will take place after the Early Deployment Study Report and the Implementation Plan and all necessary agreements have been reviewed and approved by the LDOTD and the FHWA following Federal-aid procedures.

Witnesses:

Tom Ed McHugh, Mayor-President
City of Baton Rouge/Parish of East Baton Rouge
2/17/98
(Date)

Witnesses:

Frank M. Denton, Secretary
Department of Transportation & Development
20 Feb 98
(Date)

Witnesses:

William A. Sussmann, Division Administrator
Federal Highway Administration
2/26/98
(Date)

APPENDIX C

APPENDIX C

Baton Rouge ITS Project
Communications Systems Design Evaluation

General Comments

This design evaluation provides a top-level description of three, communication network designs considered for this project and recommendations based on the National ITS Communication Architecture Definition. A cost comparison of the three designs is included and a summary of the advantages of each design.

The National ITS Architecture document provides insight to readily available and emerging technologies that can be used to implement any of the user services described in the ITS Architecture. Excerpts from the National ITS Architecture model (*in italics*) are included as points of discussion.

The design alternatives presented are for the entire network and are based on physical details of the **Primary ITS Route Plan** and **Alternate ITS Route Plan** for vehicle traffic management as shown in Figures 1 and 2. The equipment selection and architecture for each network design provides for scaleability, extensibility, network flexibility, and network management capability of the communication systems. Each of the designs use similar fiber plans for the backbone fibers (trunk cables) and field cabinet fibers (distribution cables) for the Primary ITS Routes using dedicated fiber optic cables. Additional information is provided that introduces other media types for consideration of the future Alternate ITS Route design.

"The National ITS Architecture provides a common structure for the design of intelligent transportation systems. It is not a system design nor is it a design concept. What it does is define the framework around which multiple design approaches can be developed, each one specifically tailored to meet the individual needs of the user, while maintaining the benefits of a common architecture..."

It is important to note that the ITS model stresses industry standards compliance and that the designs proposed are compliant with the applicable telecommunications standards as they are known today to allow for inter-operability and inter-connectivity of the communications equipment. Industry standards will continually evolve and be updated periodically to encompass new technologies. The ITS model recognizes this fact and does not mandate specific communication interface standards, media types or system architectures, leaving those design decisions to the user. It does provide selected recommendations based on a variety of industry standards and the cost effectiveness of the technology for the particular application.

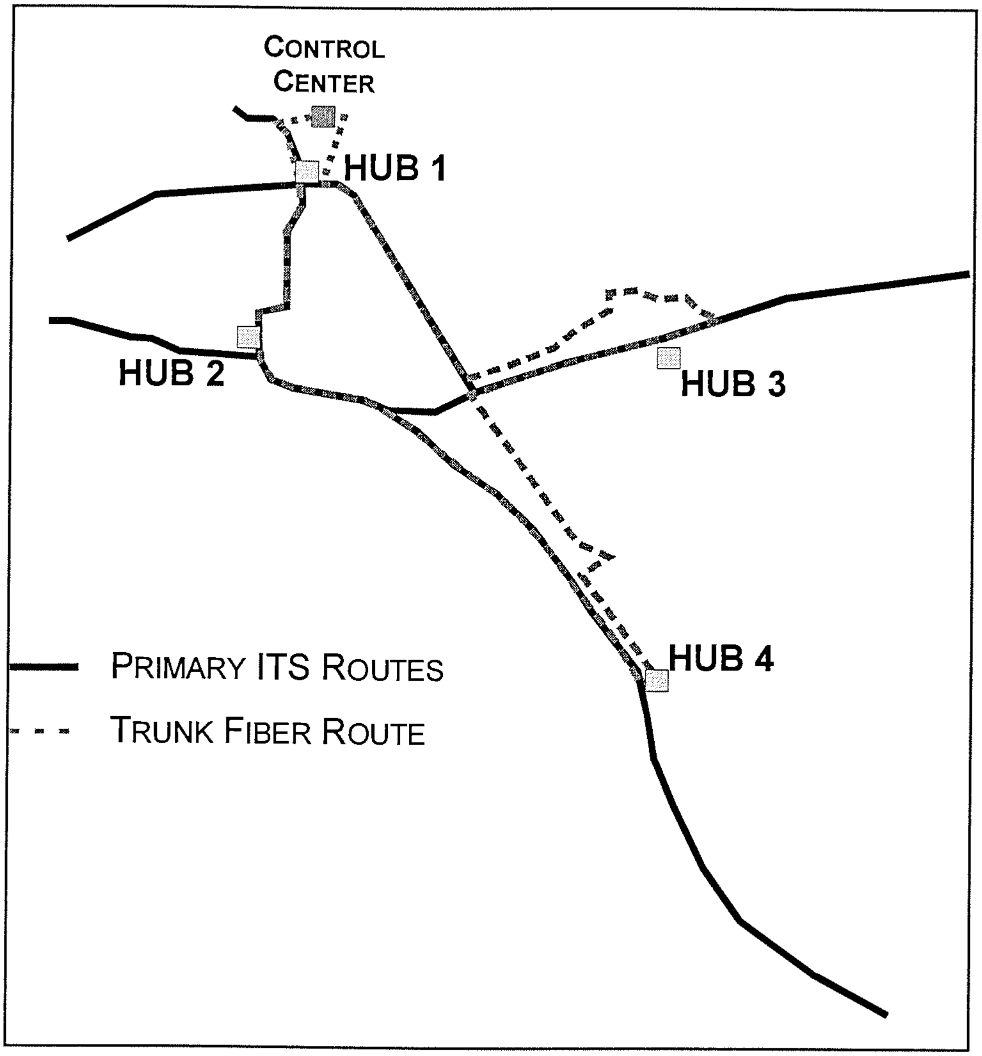

CONTROL CENTER
HUB 1
HUB 2
HUB 3
HUB 4
PRIMARY ITS ROUTES
TRUNK FIBER ROUTE

Figure 1

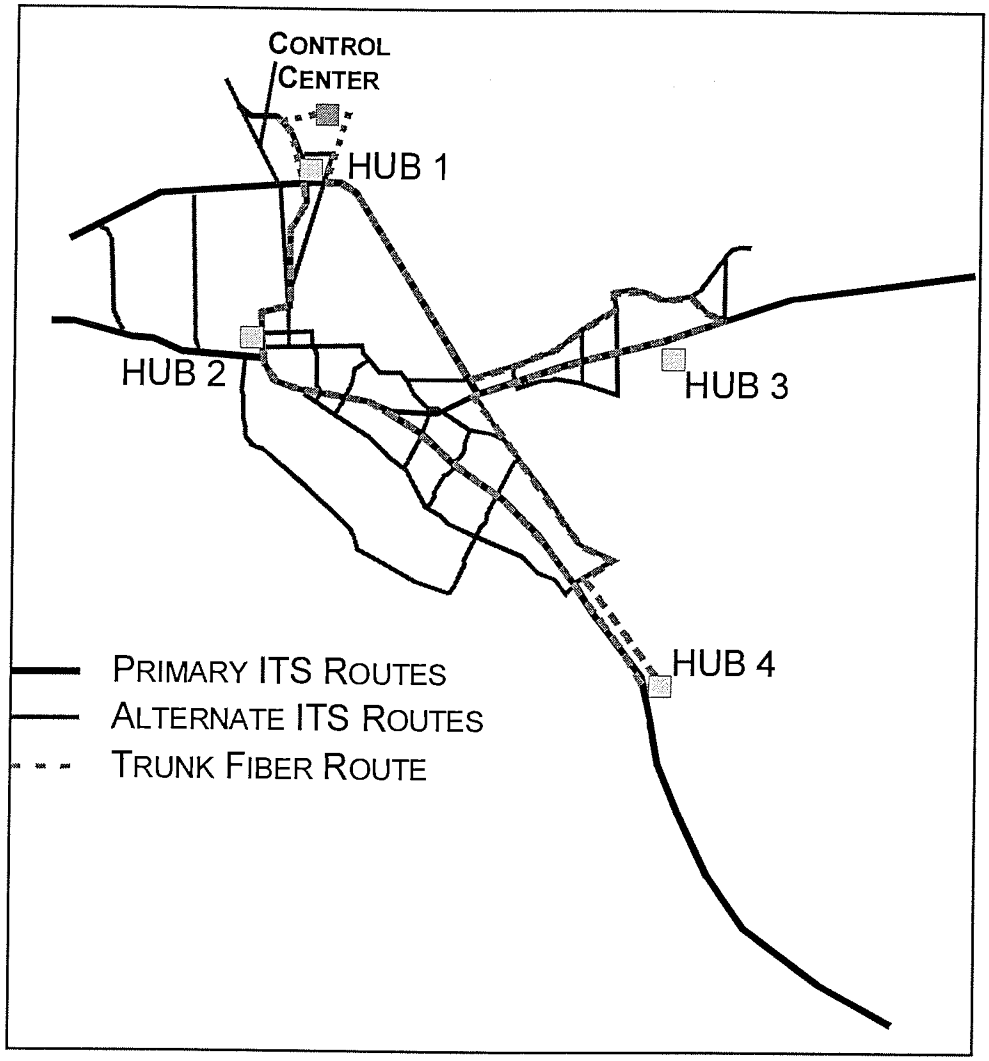

CONTROL
CENTER
HUB 1
HUB 2
HUB 3
HUB 4
PRIMARY ITS ROUTES
ALTERNATE ITS ROUTES
TRUNK FIBER ROUTE

Figure 2

"In general, the Communication architecture for ITS will have two components: one wireless and one wireline. All Transportation Layer entities requiring information transfer are supported by one or both of these components. In most cases, the wireless component merely provides a tetherless user, usually one in a vehicle, with access to fixed (or wireline) network resources."

The ITS Architecture report provides extensive detail and a number of assessments of the wireless technologies (cell based, satellite, spread-spectrum, radio), but places lesser emphasis on the wireline strategies (twisted pair, coax, fiber-optic). The assumption being that wireless will eventually become the most widely used components within the ITS communications network with the greatest potential for generating the bulk of the revenue from user services. Note that the above excerpt states "*...with access to fixed (or wireline) network resources.*" This places emphasis on establishing a base wireline system that will accommodate these wireless interfaces.

Each of the three designs is considered a wireline design (fiber-optic based) which will accept industry standard communication interfaces required for future wireless components. The wireless components being those that will support communication requirements for infrastructure to vehicle communications and other remote stationary and wireless equipment requiring connection to the fiber-optic network.

Design Considerations

The design of the three proposed communication systems for this project is based primarily on achieving an optimum utilization of the network resources (video, voice and data) and the ability to share those resources among the various agencies requiring access to them. This lead to selecting a network architecture that is inherently designed for survivability and equipment selections that provide redundancy to insure a high degree of network availability under fault conditions. Network management is an essential function that has been time-proven to reduce potential system outages and lower maintenance costs over the life of the system by automatically detecting, isolating, restoring and reporting system faults. This function is included in each of the designs.

None of the designs are considered fail-safe, but are fault-tolerant and designed to provide a graceful degradation of system resources during fault conditions. This is accomplished by selecting communications hardware that has built-in redundancy of critical components (transmitters /receivers, power supplies), is designed to operate in a network environment with path protection (counter-rotating rings, dual-path capabilities) and has integral network management capabilities for the critical components.

Each design incorporates two basic fiber schemes, 1) ring networks, and 2) point-to-point circuits, which are combined to provide a robust and flexible communications system. Figure 1 reflects the overall fiber plan of the trunk circuits for the Primary Route Plan. Figure 3 shows the distribution fiber plan used to transport video, voice and data from the field devices to the main hub at each sector.

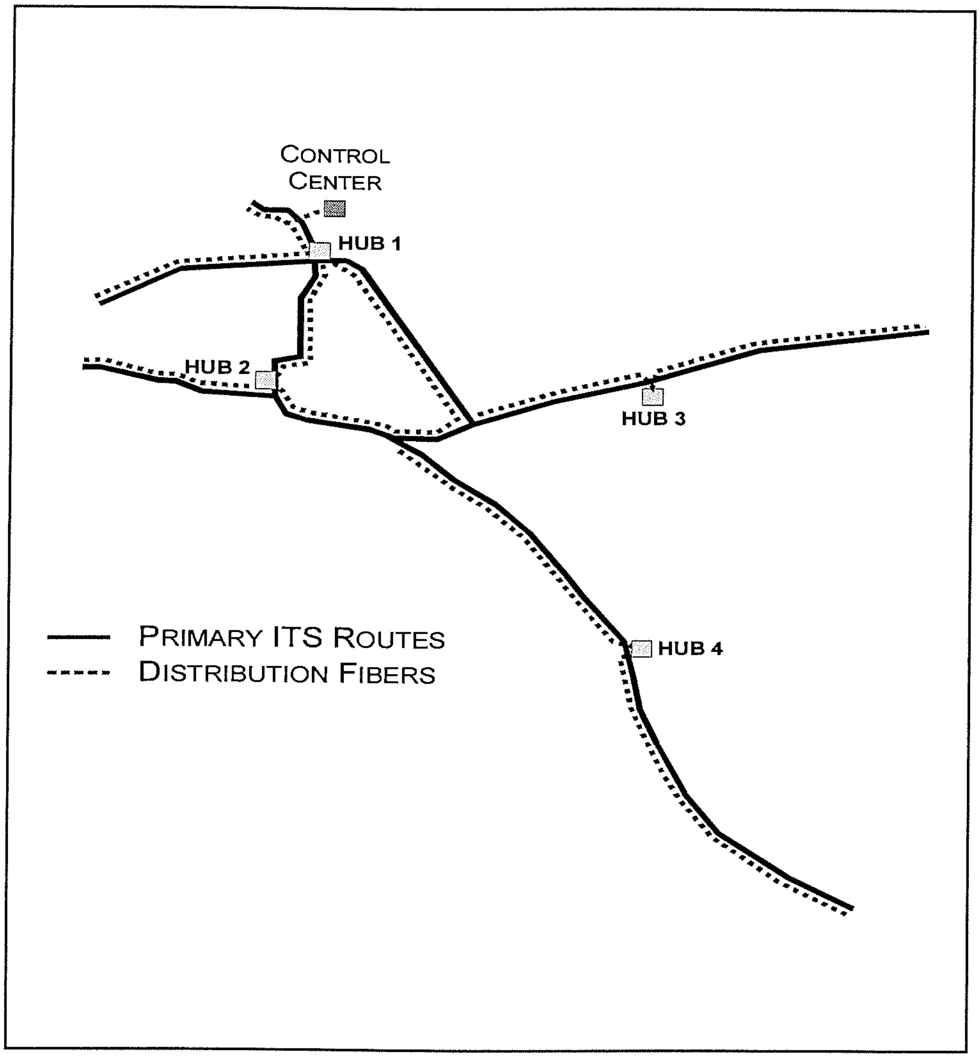

CONTROL
CENTER
HUB 1
HUB 2
HUB 3
HUB 4
PRIMARY ITS ROUTES
DISTRIBUTION FIBERS

Figure 3

The designs allow for phased build-out of the system. Figure 4 shows how the overall network is divided into four sectors. Each sector has a main communications hub that collects the video, voice and data circuits for transmission to/from the Control Center. As each sector is constructed and brought on-line, it is connected to the previous sector or Control Center in a collapsed ring network (logical ring). After the last sector is built, some trunk fibers will be reassigned to form a complete physical, fiber-optic ring backbone.

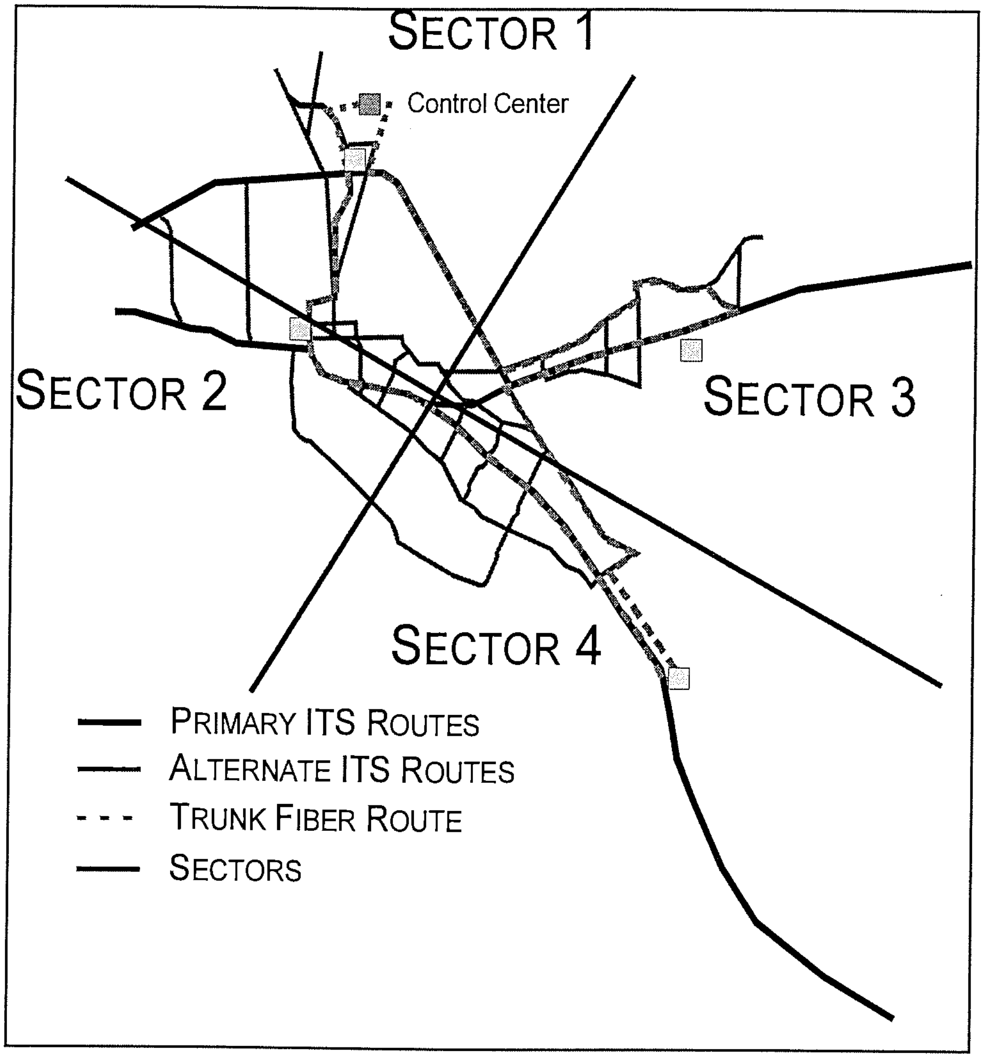


Figure 4

Basic System Elements

A "hub" is defined as an equipment location that connects to the trunk fibers and a "node" location (field cabinet) connects to the distribution fibers. Equipment housed at locations other than the Control Center are considered "slave" devices, while those at the Control Center being the "master" devices. Basically, the function of a hub is to act as a primary collection point within a sector, and a node to act as a feeder to a hub. These functions are further detailed in the System Descriptions. All node locations eventually connect to one of the four main hub locations. Equipment at a hub location may connect directly to the Control Center or to the next hub, depending on which design is being described.

Distribution Fiber Plan

The fiber plans are based on providing 144 CCTV cameras at intervals of ½ to ¾ mile increments over approximately 77 road miles, with additional traffic management equipment co-located in the same cabinets. Equipment such as traffic controllers, VMS, CMS controllers, weather sensors/monitors, weigh-in-motion detectors, highway advisory radio broadcast equipment, etc., can be installed at any of the node locations and is serviced by the network for that sector.

Of the 144 cameras proposed for the Primary ITS Route Plan, 138 of them are directly connected to a specific hub location with the remaining 6 cameras connected directly to the Control Center. The table below reflects the number of cameras connected to each hub. Figure 5 shows a graphic representation of the video point-to-point circuits connecting to hub locations via the distribution fibers.

Hub / Sector	No. of Cam
1	36
2	21
3	36
4	45
Direct to CC	6
Total	**144**

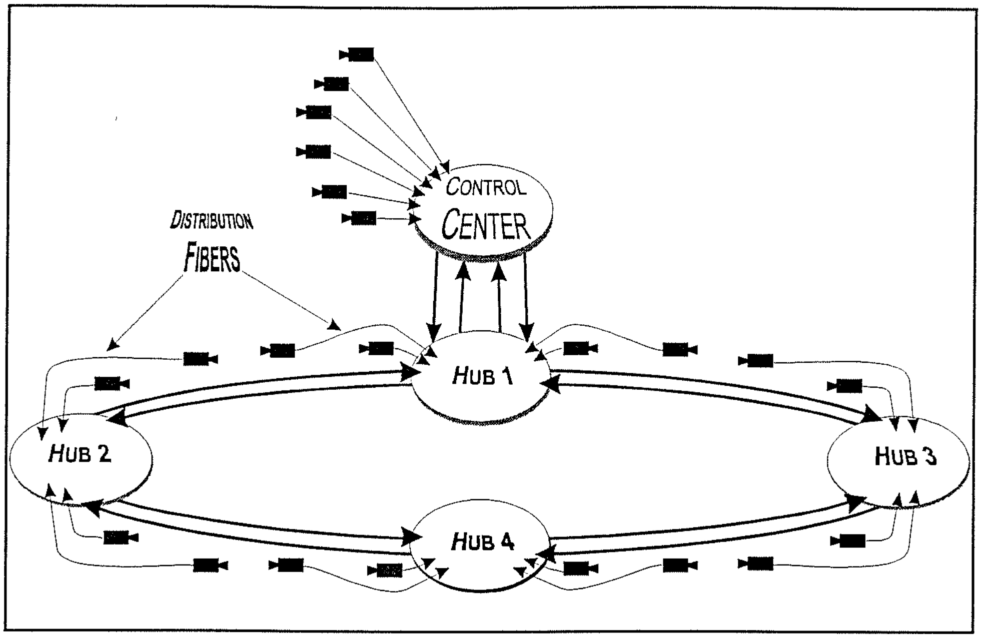


Figure 5

The relationship between the hubs, nodes, and the trunk / distribution fibers is shown in Figure 6. Communication equipment at the nodes transport the voice/data circuits from the various end-user devices over a sub-ring network on the distribution fibers which connect to the hub for that sector. Video from each camera location (Fig. 5) is sent to the hub via point-to-point fibers from the camera location to the hub location.

The sub-rings are in a "collapsed" (also known as "folded") ring configuration, meaning that fibers within the same cable will be used to connect to the voice/data equipment at each node. Of the 4 fibers required, 2 of the fibers will be used for path "A" (primary transmit/receive) and 2 fibers used for path "B" (secondary transmit/receive) forming two separate rings. In the event of a fiber break or an equipment outage, the nodes adjacent to the fault will detect the fault and reroute the voice/data traffic from path "A" to path "B", in the opposite direction (counter-rotating). This type of architecture provides a path protected network and any faults in the network are detected and reported by the Network Management System. The fiber plan for the distribution fibers is used in all three designs.

The hubs are located at mid-point of the distribution fiber spans so that approximately an equal number of cameras are located upstream and downstream of the hub in order to maximize fiber utilization.

Trunk Fiber Plan

The fiber plan for the trunk cables is dependent upon the design being described and is detailed for each in their respective System Descriptions.

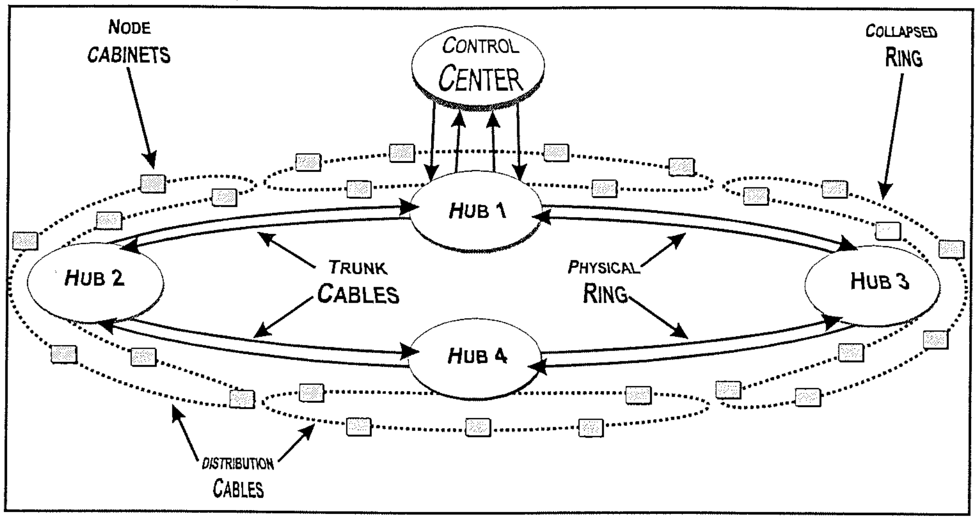


Figure 6

System Expansion

System expansion capability, sizing and system loading are fundamental considerations to the systems design which are explained in greater detail under each System Description.

A fiber-optic based system has essentially unlimited capacity in terms of the fibers transmission capabilities. Limitations are imposed primarily by distances, type of fiber and the capabilities of the communications equipment connected to the fibers. The designs proposed all use a similar fiber plan which is designed to eliminate the need for mid-span, fiber-optic repeaters which can potentially introduce signal degradation. Singlemode fiber will be specified throughout the system for both the trunk and distribution cables eliminating the need for any fiber media conversions and the equipment specified will be sized to meet the needs of the proposed system equipment for each sector and the Control Center.

To insure future growth capability of the network, additional spare fibers will be included in both the trunk and distribution cables. Additional equipment can be added to the sub-ring networks on the distribution side, or additional rings can be implemented using spare fibers. A sub-ring is limited to 63 nodes per ring with the maximum ring size at 45 nodes (Sector 4) under the proposed designs. The trunk side equipment can also be increased to accommodate future hub locations or the addition of equipment to the proposed hub locations using the same fibers or by using spare fibers.

"The ITS architecture allows the use of existing infrastructure to the greatest extent possible...."

The use of wave-division multiplexers (WDM's), provides the ability for multiple, optical wavelengths to be transmitted over a single fiber, which can be used to increase the amount of equipment connected to the same fiber. This same technology is often used within the design of a piece of fiber-optic equipment to increase its transmission capabilities.

By leveraging this technology, it is technically feasible to share public and private fiber-optic networks and is a potential candidate for inter-connecting the future Alternate ITS Route Plan communications with the main hubs on the Primary Route Plan.

For sections of the roadway where it is not practical to install fiber-optic cables or to connect to other public resources, the use of wireless technologies can be used to expand the system.

Equipment Descriptions:

This section provides a brief overview of the equipment selected for each of the design evaluations but does not provide all the specifications or capabilities for each product. Please refer to the manufacturers specification sheets for additional details about each of the products.

The final equipment selection decisions will be made during the final design stages to insure that the latest versions of the industry standards are incorporated in the system specifications.

Fiber Optic Fractional T1 Multiplexer - (TelePath FO/FT1)

This device is common to all designs.

At each node, a FO/FT1, digital multiplexer will be installed that has 8 RS232 data ports and 2 voice ports. The aggregate data rate of the FO/FT1 is the DS-1 (T1) rate of 1.544Mb/s. There are 24 addressable, channels (called DS-0's) within this aggregate data stream which transport the individual voice/data circuits. Any of these 24 channels can be assigned to any data or voice port on the FO/FT1 multiplexer. Each channel is bi-directional (full-duplex), meaning that data can be sent in both directions at the same time.

The data ports are multi-point / multi-drop capable with data rates up to 38.4Kb/s for each port. This allows the same data channel at each node to be dedicated to a specific function required at any or all nodes in that sector.

As an example, the CCTV video camera's require the Pan, Tilt and Zoom (PTZ) commands to control a camera from the Control Center. Each camera in the system is assigned a distinct address, and a receiver/driver that decodes received messages via the communications network. A command message from the Control Center will be broadcast to all the camera's in a sector, and each receiver/driver will decode the message and check for a valid address. If the message received contains the address for that particular camera, the camera will respond to the commands, otherwise it ignores the message.

Since the camera controls (PTZ) are low speed, typically set for 19.2Kb/s, and have a very low volume of message traffic, a single channel on the FO/FT1 can be used to control all the cameras in a sector.

One of the two voice channels on the FO/FT1 is dedicated to a Service Voice Link function that is used as a Maintenance Hot-Line (similar to order wire capability). This is a party line configuration and allows a technician at any node, anywhere in the system to communicate with any other node and the Control Center. Conversely, the Control Center can talk to any node. .

The second voice circuit is a Highway Advisory Radio (HAR) port (4W, 600 ohm) that is used to transmit messages from HAR equipment at the Control Center to remote broadcast radios.

Each FO/FT1 has 2 sets of relay contact closures and sensors that can be wired to sense for cabinet doors being opened, shelter temperature alarms or any other type of alarms suited for contact closures/sensors. These contacts are monitored and controlled via the Network Management System (NMS) at the Control Center.

The FO/FT1 is fully programmable and can be remotely programmed from the NMS at the Control Center. Data and voice port parameters can be changed on-the-fly, and each port is continually monitored by the NMS for alarm conditions. The FO/FT1 has one field replaceable transceiver module and does not require periodic maintenance, alignments or special tools to replace the transceiver module.

One FO/FT1 will be located at each node and hub (slaves) and one for each sector (master) will be located at the Control Center. This unit requires 1 RU (Rack Unit = 1.75") of vertical rack space.

Fiber-Optic Dual Ring Transceiver - FO/DRT (TelePath RingMaker)

This device is common to all designs.

The FO/DRT provides path protection for the FO/FT1 described above. It contains 3 field replaceable transceiver modules for connecting to the distribution fibers (paths "A" and "B") and to the FO/FT1 (payload) along with redundant power supplies. It continually monitors the status of the fiber paths and performs the automatic switching and bypass functions should a path or equipment fault be detected.

The FO/DRT is managed and monitored by the NMS and can be remotely programmed by the NMS. The FO/DRT does not require periodic maintenance, alignments or special tools to replace the transceivers or power supply modules. One FO/DRT will be located at each node and hub (slaves) and one for each sector (master) will be located at the Control Center. This unit only requires 1 RU (1.75") of vertical rack space.

FDM Broadband Video/Data Multiplexer - FDM (TelePath TransPorter 5000)

This device is used in two of the designs - Designs 1 and 2.

For video transmission, a broadband FDM (frequency-division multiplexer) has been chosen as the most cost effective solution for transporting un-compressed, full-motion, broadcast quality video from the hubs to the Control Center. The FDM meets video industry standard EIA-250C mediumhaul specifications, has redundant power supplies, transmitters and receivers and is monitored and controlled by the NMS.

The FDM can be configured for video and/or DS-1 channels, or combinations of both and provides bi-directional transmission capability. Each chassis can multiplex up to 24 full-motion, video channels (3 channels per card) and 2 chassis can be combined for a total of 48 video channels or a combination of video and DS-1 channels on the same fibers.

The FDM and its sibling 9 channel multiplexer (TelePath 2500), have the ability to add/drop channels at multiple locations which is being considered as part of the communications design for the future Alternate ITS Routes.

The FDM's will be located at each hub (slave) and at the Control Center (master). Each unit only requires 6 RU (10.5") of vertical rack space.

Fiber-Optic Video Transceivers - (FO/VT)

This device is common to all designs.

Video transmission from the camera to the hub is accomplished using the FO/VT which transmits the output analog video signal from the camera to the FDM located at the hub via the distribution fibers. Two units per camera link are required. One mounted at the camera converts the video signal from an electrical signal to an optical signal. The second is located at the hub to convert the optical signal to electrical.

A number of manufacturers make these products and the final selection will be done during the final design stage. It is necessary to insure that the unit selected is suitable for the camera types selected and will physically fit into the type of camera housing selected for the project.

Digital Video Codec - (DVC)

This device is used in Design 3 only.

There are a number of manufactures that are pursuing this niche market and the following statement from the ITS document indicates but one of the digital compression technologies available.

"One design assumption that drives the second-largest data load is the selection of a video encoding standard. In this document the MPEG-1 standard has been selected. The data rate is 1.5 Mbps. This decision was based on the fact that MPEG-1 provides a high quality full-motion video image that can be readily demonstrated today. The development of inexpensive MPEG-1 encoders and decoders has been completed, and the cost will decline rapidly in the near term. This assumption can be revisited in the future when the time for an actual deployment is nearer. The tradeoff between the cost of the encoder/decoder pair and the cost of transport should be studied then, because of the rapid developments in the area of video encoding..."

There have been a number of advances in digitizing and compressing video since the ITS document was researched and released. MPEG-1 has been eclipsed by the newer MPEG-2 standard and other video compression standards are becoming more attractive in price and provide higher quality. Digitizing video incurs tradeoffs, since it either requires a great deal of transmission bandwidth to achieve broadcast quality video signal (up to 155 Mbps), or reducing the quality of the video signal in order to save valuable bandwidth. The amount of bandwidth required per video signal dictates the payload capacity of the transmission equipment at the hubs must provide.

In the all-digital design proposal for this project, the H.261 standard was selected as the most cost effective solution among the technologies presently available. It can transmit the digitized video at scalable data rates from 64 Kbps to 2.048 Mbps, (low to higher quality) and being a more widely used product in video conferencing applications, it's pricing is lower for similar quality video but it does not meet the EIA-250C standards.

This device converts the analog signal from the camera into a digital data stream (1.5 Mbps) which is then connected directly to the SONET multiplexers at the hub. At the Control Center, another codec is required to decode the signal and convert it back to analog for distribution by the video switch.

SONET OC-3 / OC-12 - (SONET ADM)

This device is used in two of the designs - Design 2 uses OC-3 and Design 3 uses OC-12.

Synchronous Optical Network, Add Drop Multiplexers (SONET ADM) are used in two of the designs and are a cost effective solution for transporting large quantities of voice and data signals in a ring network. The equipment selected provides path protection ("A", "B" routes), redundant transmitters/receivers and power supplies, protected user circuits (DS-1's), battery backup as well as being controlled and monitored by a Network Management System at the Control Center. SONET is widely used throughout the telco industry and is well defined in the Bellcore specifications.

The addition of SONET in the base design provides the capacity to add Ethernet (10 / 100 Mb), wireless interfaces for voice and data and add other user services to this private network that are now being leased on the public networks.

In brief, SONET defines optical carrier (OC) levels and electrically equivalent synchronous transport signals (STSs) for the fiber-optic based transmission hierarchy. The standard SONET line rates are shown in the table below. The fiber-optic rates shown in bold are the most widely supported by both network providers and vendors. The column labeled "# of Phone Lines" is used to provide the reader with a perspective of the number of standard (64 Kbps) telephone circuits each OC level can transport. Actual capacity required and utilized in any design will be dependent on the mix and type of user channels employed.

SONET Optical Line Rates			
Optical Carrier Level	Line Rate Mbps	# DS-1's at 1.544 Mbps	# of Phone Lines
OC-1	**51.84**	**28**	**672**
OC-3	**155.52**	**84**	**2,016**
OC-12	**622.08**	**336**	**8,064**
OC-24	1244.16	672	16,128
OC-48	**2488.32**	**1,344**	**32,256**
OC-192	**9953.28**	**5,376**	**129,024**

Selection of the SONET equipment has been narrowed to two different manufactures and was based on their equipment being compatible with the SONET Interoperability Forum (SIF) and Bellcore specifications. This will insure future growth capabilities of user services and reduce the risks of interconnecting with public network resources that implement various SONET standards and use multiple manufactures for supplying SONET based services. This will become an important issue since the design of the future Alternate ITS Route Plan most likely will be dependent upon using some telco leased services and a mix of wireless (leased or user owned) connections to the SONET fiber-optic backbone network.

Sizing and interface definitions of the SONET system (OC level and type of service) are based on the ITS application for the designs being presented. It is anticipated that these requirements will change to include additional user services as defined by the ITS model. The function of the SONET ring network is information transfer and distribution, and will essentially remain the same no matter which SONET OC level is selected.

Of the two manufacturers being considered, Positron equipment offers a growth path from OC-3 to OC-48 that requires only changing the optical transmitter/receiver pairs to upgrade to the next level. This will allow the system to be easily expanded to meet future growth requirements at minimal cost. They also offer Ethernet capability for both standard 10 Mb and Fast Ethernet, 100 Mb capability. Another advantage is that the SONET equipment can be field upgraded to the next level without incurring any system outages during the upgrade process.

The second manufacture, Nortel, incorporates an architecture capability that lends itself better to building "mesh" networks. A mesh network is one in which there are multiple locations within a ring network that typically only need to transport information between specific locations on the ring, but not necessarily to all locations. This allows more precise sizing of the system equipment (OC levels) specific to the needs of those locations.

The topology of the SONET network will start as a point-to-point configuration (Control Center to first hub installed) and build-out to a linear, folded ring (Control Center to 1st, 2nd and 3rd hubs) to finally a geographically diverse, path protected ring network (Control Center to 1st, 2nd, 3rd and 4th hubs and back to the Control Center).

Network Management System - (NMS)

This function is included in all three of the designs.

Management of critical system components is key to maintaining a communications network at a high degree of availability. Network availability of 99.9% is a typical figure used in the industry as defined by Bellcore specifications.

The ability to monitor and control system components in a real time environment along with the ability of the equipment to automatically switch to protected paths/circuits constitutes the basics of network management. The function of monitoring includes detection, isolation and reporting of alarm conditions, and providing an overall view on the health and welfare of critical system components. The level to which this is accomplished distinguishes a simple network management system from a comprehensive one that provides reliable and timely system status.

The depth to which a network management system can view individual cards/modules/interfaces within an equipment chassis is important in identifying the faulted components that need to be replaced. This eliminates and/or greatly reduces the time, test equipment and level of expertise necessary to troubleshoot and restore the system. The ability to remotely control system components from a central location allows for changing equipment parameters, performing equipment verification checks, circuit restoration procedures and allocating system resources as needed.

The determination of what the Network Management System shall entail is dependent upon the selection of the equipments and overall design of the system. There is no, "one size fits all" type of NMS available in the commercial world but the ITS model does recommend that the Simple Network Management Protocol (SNMP) be implemented in order to maintain an open systems architecture approach.

Video Matrix Switch

This device is used in all of the designs. *Costs are not included in the budgetary estimates.*

Although not considered as part of the communications equipment, it is important to recognize that the selection of the video matrix switch equipment can effect the overall price of the system and type of components selected.

In Design 3, video encoders are used at the hubs to digitize to the video signals for transmission to the Control Center. Corresponding decoders are used at the Control Center, to decode the video signals for display. This creates a one-for-one relationship, 144 encoders, 144 decoders. By selecting a video matrix switch that can switch the digital DS-1 signals, the number of decoders can be reduced to the number of display monitors being viewed at any one time.

For instance, if a total of 48 display devices (monitors, projection displays, etc.) are used throughout the Control Center, then only 48 video decoders are required, not 144. This reduces system cost as detailed in Design 3 for the all-digital System Description.

System Descriptions

The following descriptions rely on the reader having read the above to understand the basic architecture of the trunk and distribution fiber plants. In all designs, the equipment connected to the distribution fibers at the nodes is similar. The equipment at the hubs and Control Center changes for each design package.

Design 1 - Wideband Video and DS-1 Digital Data

Figure 7 reflects the equipment configuration for the remote locations (nodes and hub). At the hub shelter, the wideband FDM is used for the transmission of the video (simplex), and voice/ data circuits (bi-directional) from each node to the Control Center. Video from the camera locations is converted to an optical signal by the FO/VT and transmitted to the corresponding FO/VT receiver at the hub by way of the distribution fibers. The output of the FO/VT receivers is connected to the wideband FDM video channels. In this design, a maximum of 45 video channels are collected at the hub.

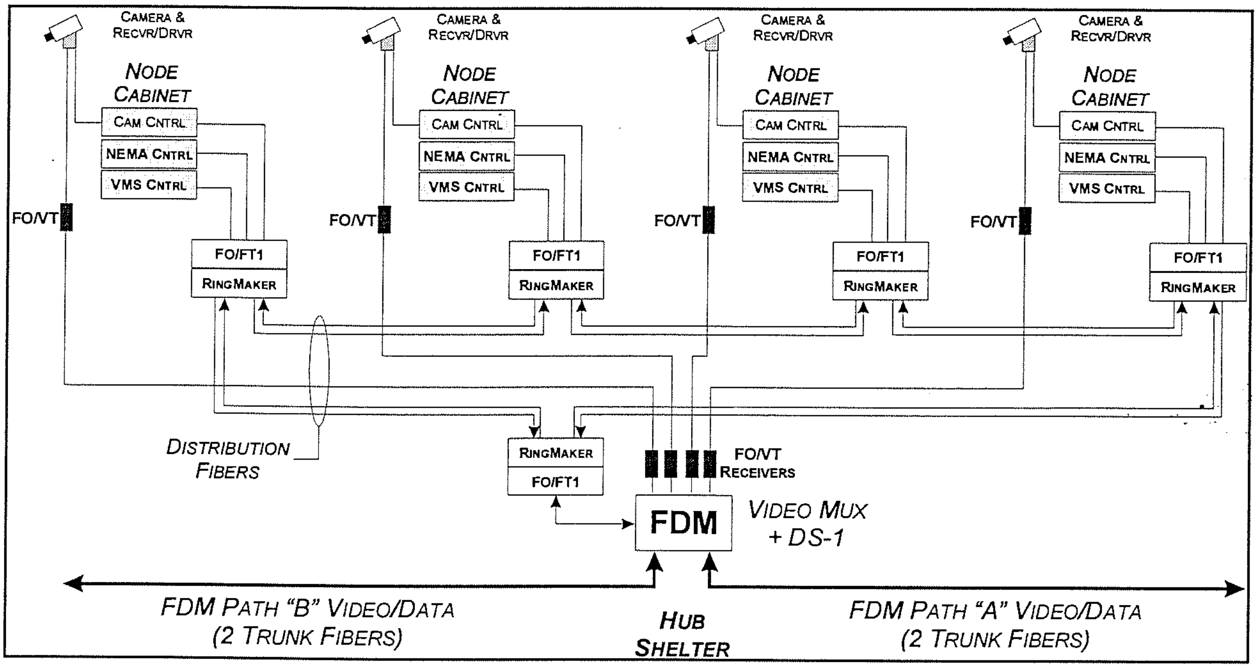


Figure 7

Each node contains both a FO/FT1 (Fiber Optic Fractional T1 digital multiplexer) and a FO/DRT (Fiber Optic Dual Ring Transceiver) combination for transmitting the bi-directional voice and data circuits in the sub-ring network. The example shows how user devices (camera, traffic and sign controllers) connect to the FO/FT1's. Up to 8 different data devices can be connected at each node and each device is assigned to a dedicated data port on the FO/FT1 multiplexer that will function as described in the camera controller example given under the FO/FT1 equipment description.

It is assumed that each hub location will also have several co-located controllers (camera, traffic, sign etc.), and a FO/FT1 and FO/DRT pair will be housed at the hub for these devices. If there are no devices co-located at the hub shelter, the FO/FT1 can be deleted from the hub location.

The FO/FT1 and FO/DRT's at each node location are interconnected using 4 fibers in a collapsed ring configuration (see Fig 7). Should a fiber cable be cut or equipment fail, the data/voice circuits will be routed from the "A" fiber path (primary fiber path) to the "B" fibers (secondary fiber path).

Individual video signals from the camera locations to the hub are not protected and a fiber break or equipment failure for the individual video signals will result in a loss of that signal to the Control Center.

The FDM multiplexes the signals for transmission to the Control Center via 4 trunk fibers. Two fibers are used for the redundant transmitters and receivers of the "A" (primary transmit/receive) fiber path, with the other 2 fibers used for the "B" path (secondary transmit/receive) providing a geographically diverse, path protected network to the Control Center as shown in Figure 8.

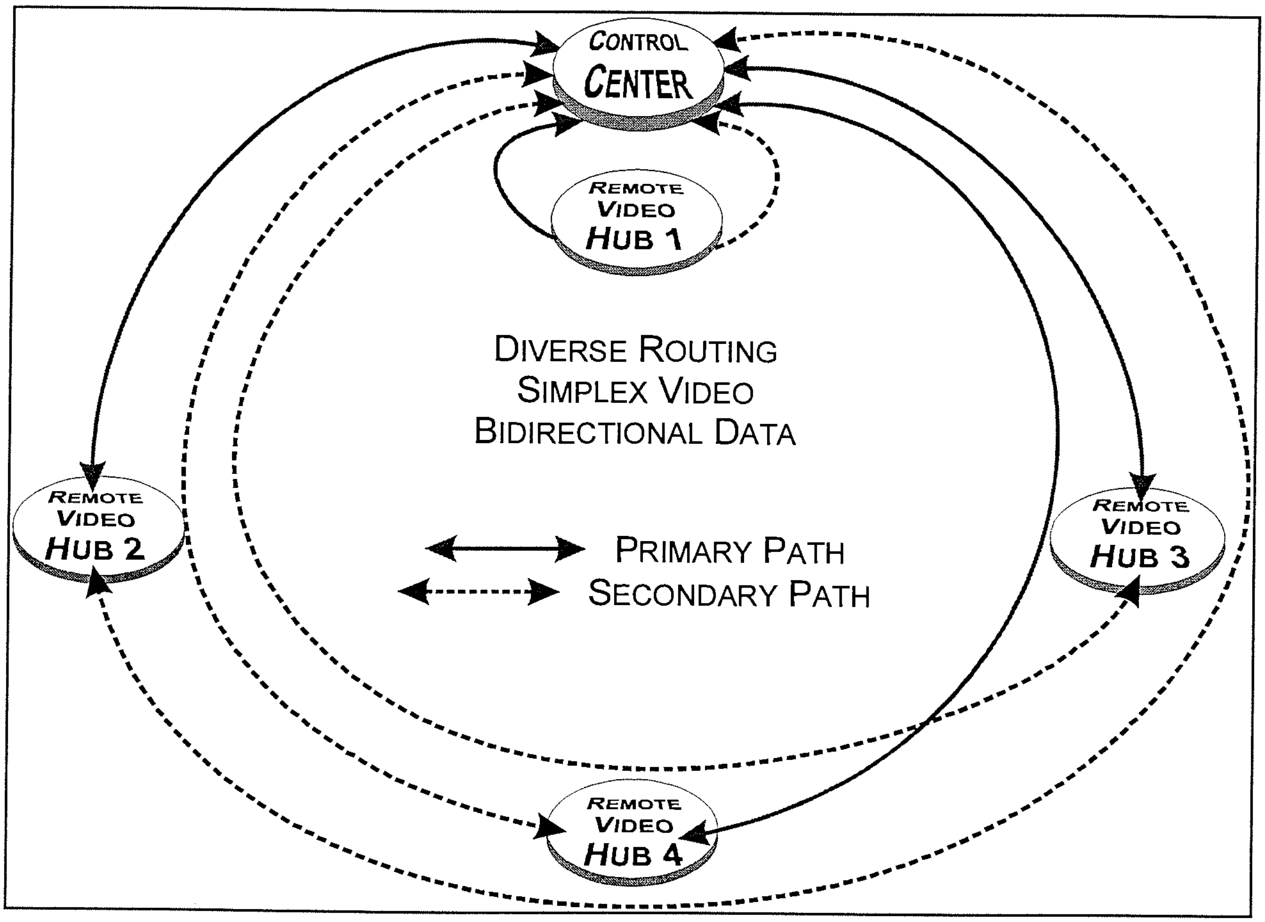


Figure 8

Figure 9 shows a partial example of the configuration of the Control Center equipment for this design. Only 2 of the wideband FDM links are shown for clarity. The video and data from the remote hubs are received by the corresponding FDM's and distributed to the user equipment.

The Network Management System physically connects to each piece of communications equipment at the Control Center via an EIA-485 bus for control and monitoring. Connection to the remote equipment is accomplished in the overhead messages from the respective master device at the Control Center, to the slave devices located at the hubs and nodes.

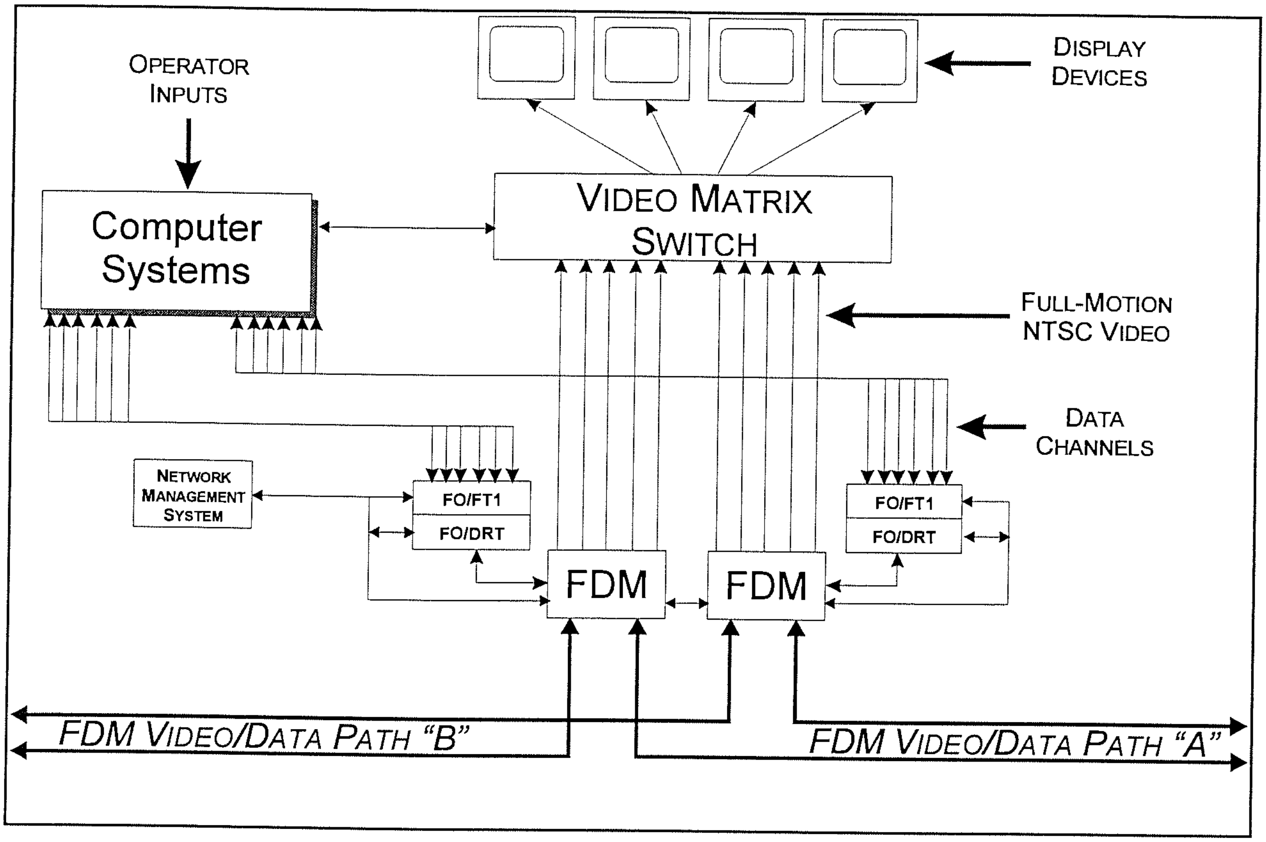


Figure 9

The network manager is a standard Pentium class PC with the Windows NT™ Operating System and the TeleVue Network Management System (TNMS) application software. The TNMS software will allow the network manager function to perform as an SNMP proxy agent so that all the communications equipment will be capable of being monitored by a master SNMP compliant network manager (not shown) via an Ethernet connection. This master SNMP network manager will be capable of monitoring and controlling other Local Area Networks (Ethernet LANs) used within the system. The decision to combine these on a single PC platform or to partition these network managers onto separate PC platforms will be made during the final design stage when all LAN requirements are established. The dashed lines in the drawing represents the connections between the NMS and the communications equipment.

Design 1 - Communications Equipment Quantities and Budgetary Costs

Budgetary costs are based on manufactures list prices for the equipment only and is based on a design for 4 hub locations, 144 nodes and the Control Center. Costs are for the following communications equipment:

Qty	Equipment
14	FDM chassis (with redundant transmitters/receivers, power supplies and all modules)
149	FO/FT1's (with electrical transceiver)
149	FO/DRT's (with 2 singlemode and 1 electrical transceiver, redundant power supplies)
288	FO/VT's (SM fiber version, video only, simplex)
1	Maintenance Hot Line Telephone System (chassis and modules)
1	TeleVue Network Management System (PC, Operating System and NMS software)

Design 1 Budgetary Estimate - Wideband Video + DS-1 Digital Data		
Cost Per Hub Plus Node Equipment	**Remote Equip**	**Control Center**
Hub 1 (36 Video + 1 DS-1)	$426 K	
Hub 2 (21 Video + 1 DS-1)	$254 K	
Hub 3 (36 Video + 1 DS-1)	$426 K	
Hub 4 (45 Video + 1 DS-1)	$518 K	
CC (138 + 6 Direct Video + 5 DS-1's)		$463 K
Sub Totals	**$1.62 M**	**$463 K**
System Total	**$2.08 M**	

Design 2 - Wideband Video and SONET

Design 2 is a growth step for the previous design and incorporates SONET for transporting data and voice circuits between the Control Center and hubs for distribution to the node locations. The addition of an OC-3 SONET ring (or greater - OC-12 / OC-48) servicing the 4 sector hubs and Control Center is predicated on the likelihood that future user services will be added to the system that will exceed the DS-1 (1.544 Mbps) capability per sector, as used for Design 1. Design 2 can be implemented whenever user services require additional bandwidth beyond this DS-1 rate per sector.

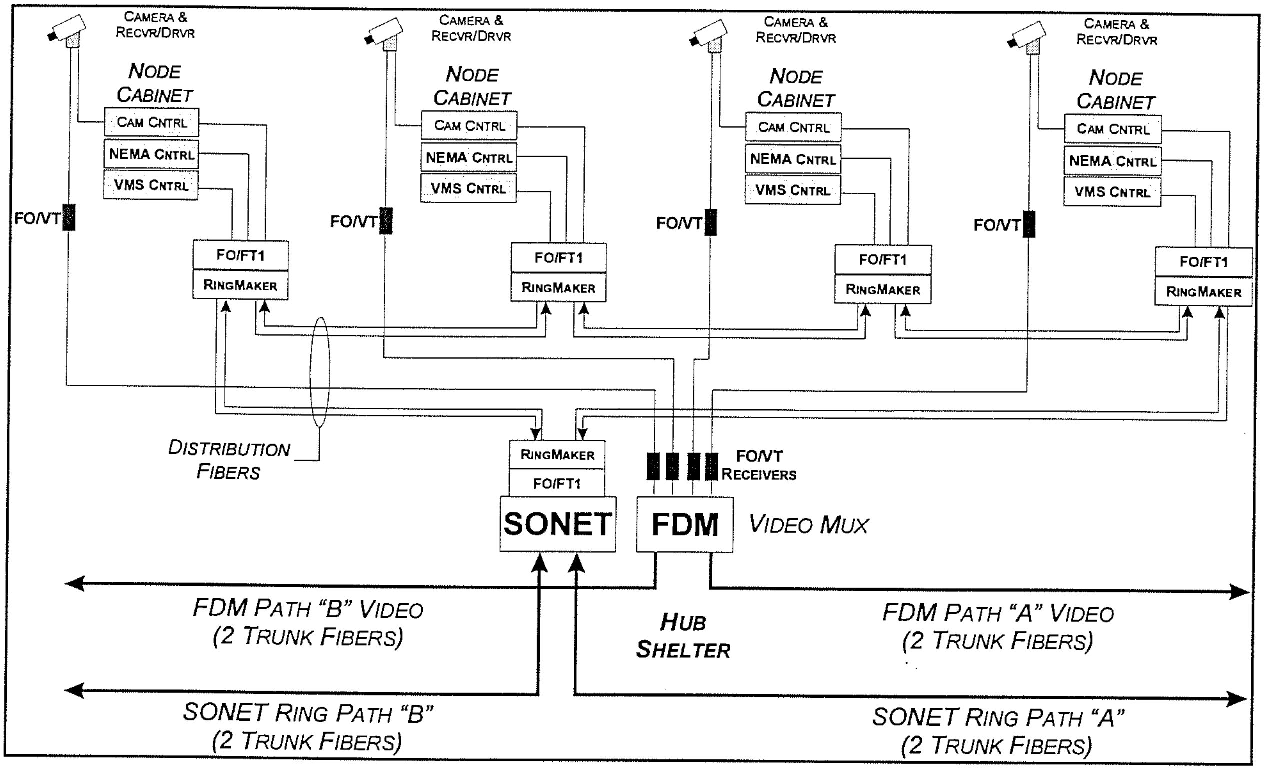


Figure 10

It is important to note that Design 1 required a bidirectional data flow capability between the FDM's at the hubs and the FDM's at the Control Center to transmit and receive the data/voice circuits and the Network Management System overhead messages. (Video signals are from the hub to the Control Center and only require a simplex (one-way) transport path.)

Design 2 also consists of wideband video and the same equipment complement and configuration for the node locations as in Design 1. The primary difference is in the transport of the DS-1 circuits to each hub. In Design 1, the DS-1 to each sector hub is combined in the aggregate data stream of the FDM's (fig. 7). Design 2 deletes the DS-1 cards and the bidirectional capability in the FDM's and all data and voice circuits are transported by an OC-3 (155 Mbps) SONET ring network as shown in Figure 10.

The removal of the bidirectional capability of the FDM's saves the cost of the transmitter/receiver cards associated with transporting data/voice and NMS messages from the Control Center to the hub. The use of a dedicated, bidirectional data port (1 of 8 available) on the FO/FT1 is used to transmit and receive the NMS overhead messages. The FDM's retain their dual-path (redundant and diverse) capability from the hubs to the Control Center as shown in Figure 8.

A SONET ring is generally of one of two basic types: a Unidirectional Path Switched Ring (UPSR), or a Bidirectional Line Switched Ring (BLSR). Each type of ring features fully self-healing operation and the different features may make one topology preferable in certain situations. For example, a BLSR architecture is a good choice for networks with a highly distributed mesh traffic pattern, such as would be expected in a public telco environment. While the UPSR is an excellent choice for private systems where the data terminates at a central location such as the Control Center in an ITS application.

Design 2 uses the UPSR self-healing topology for the SONET but the decision on which system will be selected will be based on requirements for Ethernet LANs, bypass circuits (bypass of telco leased services), wireless components and other supplementary requirements.

The self-healing capabilities of a SONET ring under fault conditions is illustrated in Figures 11 and 12 for a single and double fault condition, respectively. With a single fault condition, the node equipments adjacent to the fault (hub 3 and 4 in this example), sense the fiber break due to a loss of a receiver carrier (optical signal). The adjacent SONET equipment automatically generates an alarm condition that is sent to the SONET NMS.

The NMS then commands the adjacent hubs to route the data to the "B" path which isolates the fault condition, restores communications, reports and logs the fault condition. When the fault condition is repaired, the alarm event is automatically cleared, system status is updated but data flow remains on the "B" path until manually configured at the NMS. This prevents circuit hunting (intermittent switching between path "A" and "B") which can cause data delays and lost messages.

A double fault condition virtually isolates a hub and can be caused by a power outage at a hub, cable cuts, equipment failures or a combination of failures. While communications to the affected hub is lost, the rest of the ring remains intact and a total system outage is averted.

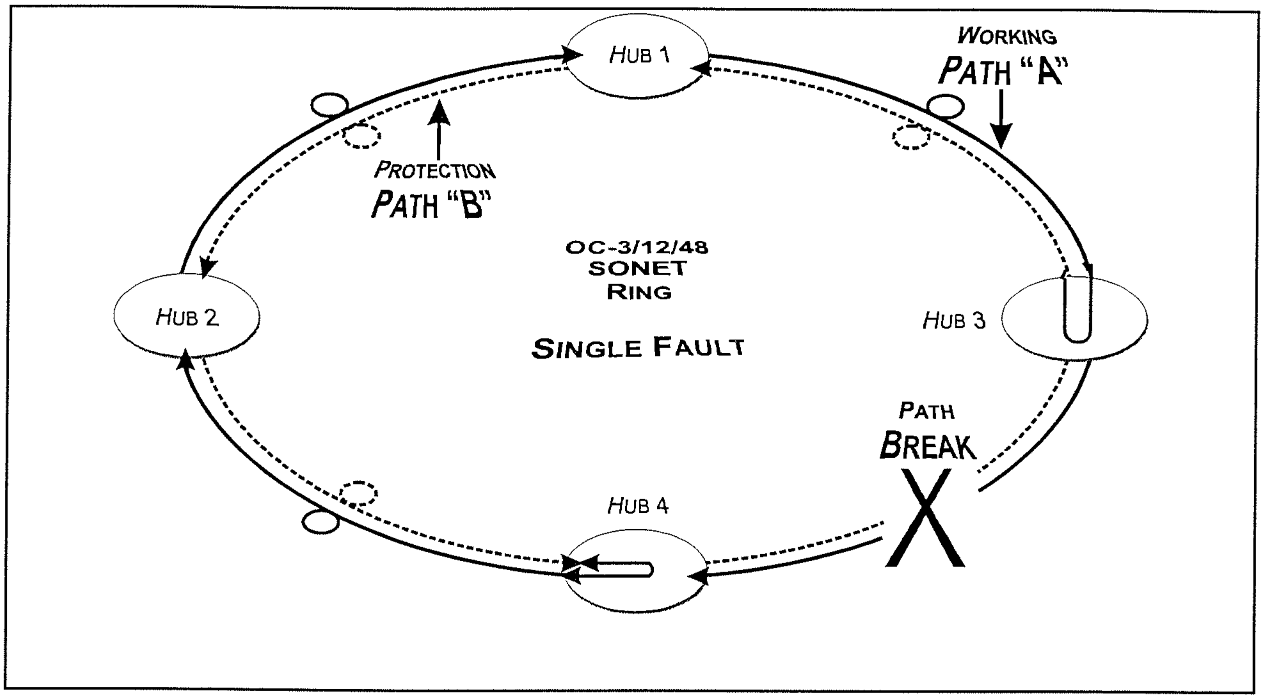


Figure 11

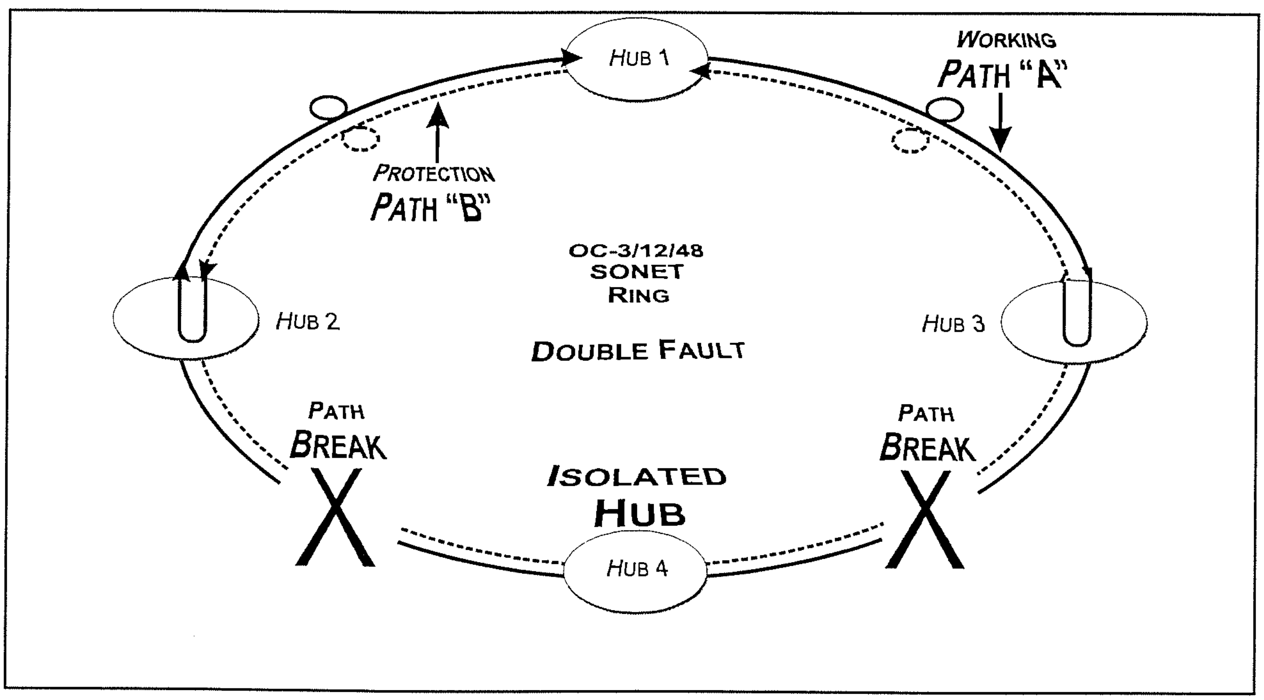


Figure 12

The Control Center equipment configuration for Design 2 is illustrated in Figure 13. Depending on the OC level (OC-3, OC-12 etc.) chosen for the SONET ring, one or two chassis are required at the Control Center and are equipped with a 4 port, DS-1 channel card (mapper) for each hub. For an OC-3 SONET multiplexer, up to 84 DS-1 channels (1.544 Mb each) can be configured or a combination of DS-1's and 10 Mb Ethernet channels.

Options include DS-3 (45 Mb) and 100 Mb Ethernet channels but these options only make sense when configured with an OC-12 SONET (622 Mb network) or greater due to the bandwidth required for these options.

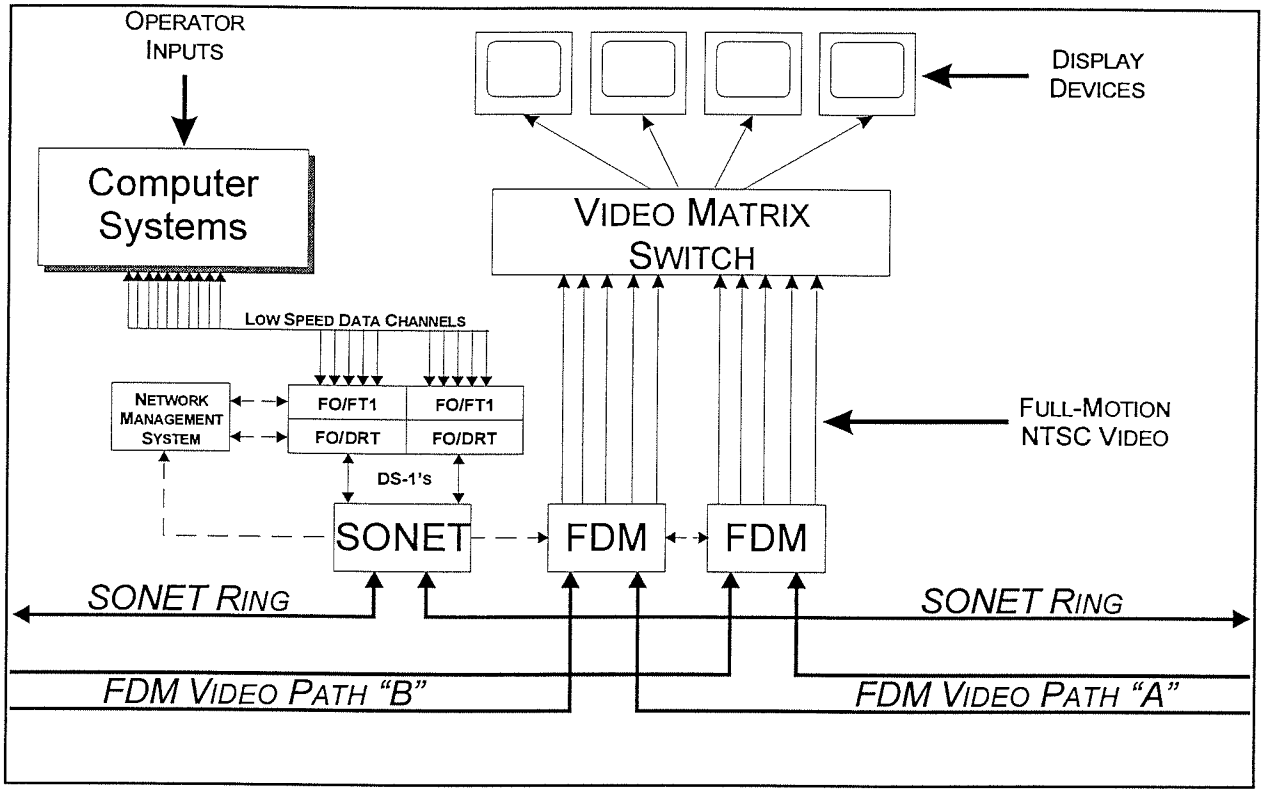


Figure 13

The DS-1 channels from the FO/FT1 and FO/DRT are connected directly to the SONET multiplexer and the DS-1 channels in the SONET multiplexer are 1:N protected. Meaning, that for every 7 DS-1 channels installed, there is one SONET backup spare channel that is automatically switched into service should a DS-1 mapper card fail.

The FDM's in Design 2 are configured for simplex video only since the data/voice channels are carried by the SONET network. This reduces costs by eliminating the transmitters/receivers required for bidirectional data flow.

Figure 14 shows the geographically diverse routing after system build-out is completed.

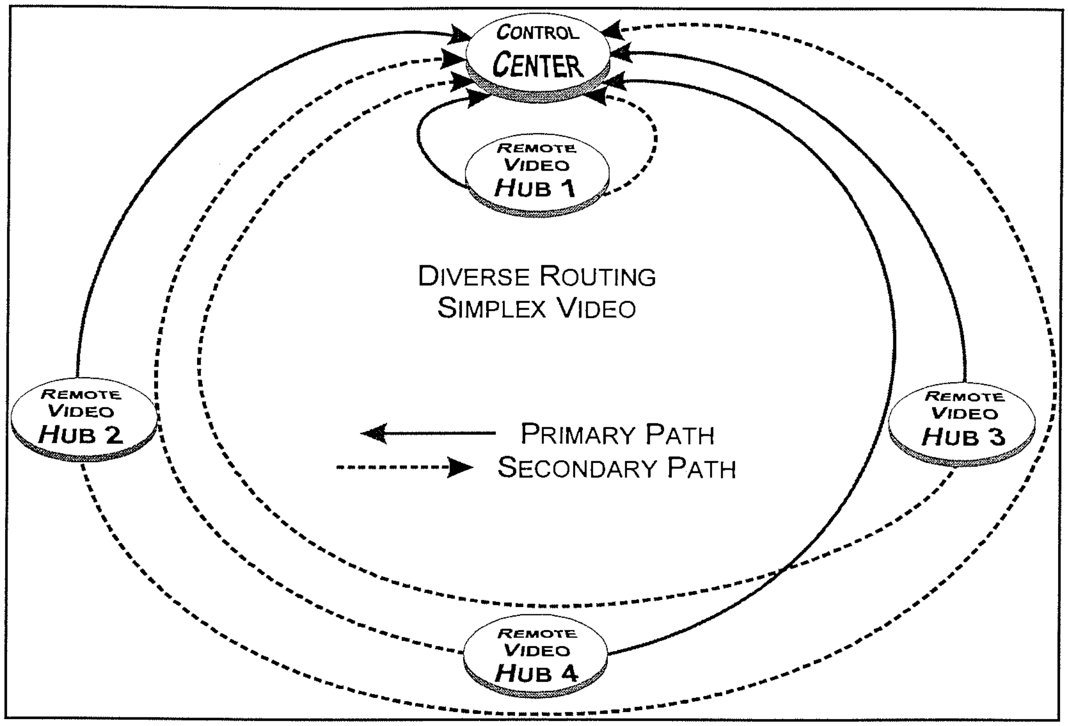


Figure 14

During build-out, the primary and secondary paths would be within the same trunk cable segment back to the Control Center as shown in Figure 15, which shows hubs 1, 2 and 4 as being completed.

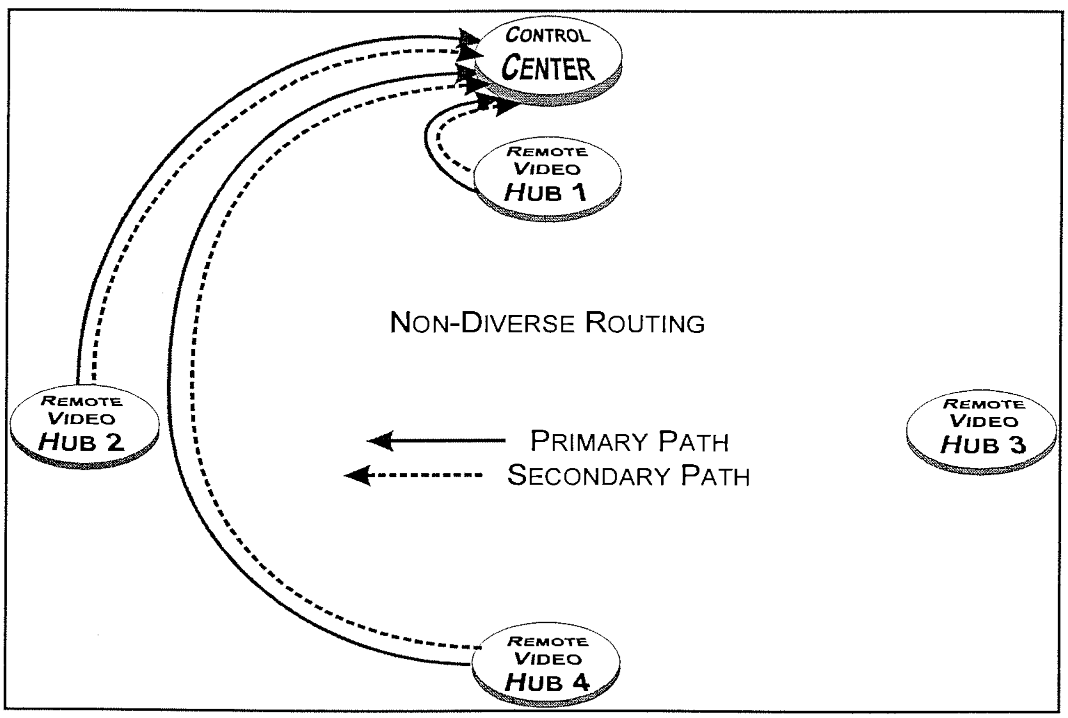


Figure 15

Design 2 - Communications Equipment Quantities and Budgetary Costs

Budgetary costs are based on manufactures list prices for the equipment only and is based on a design for 4 hub locations, 144 nodes and the Control Center. Costs are for the following communications equipment:

Qty	Equipment
14	FDM chassis (with redundant transmitters/receivers, power supplies and all modules)
149	FO/FT1's (with electrical transceiver)
149	FO/DRT's (with 2 singlemode and 1 electrical transceiver, redundant power supplies)
288	FO/VT's (SM fiber version, video only, simplex)
1	Maintenance Hot Line Telephone System (chassis and modules)
1	TeleVue Network Management System (PC, Operating System and NMS software)
5	OC-3 SONET Add Drop Multiplexers (configured with 4 DS-1's per hub)
1	SONET Network Management System

Design 2 Budgetary Estimate - SONET + Wideband Video		
Cost Per Hub Plus Node Equipment	**Remote Equip**	**Control Center**
Hub 1 (36 Video OC-3 SONET)	$437 K	
Hub 2 (21 Video + OC-3 SONET)	$265 K	
Hub 3 (36 Video + OC-3 SONET)	$437 K	
Hub 4 (45 Video + OC-3 SONET)	$530 K	
CC (6 Direct + 138 Video + OC-3 SONET)		$436 K
Sub Totals	**$1.67 M**	**$436 K**
System Total	**$2.11 M**	

Design 3 - All Digital Video/Data Over SONET

Design 3 is an all-digital design that digitizes the video at the hubs for transmission to the Control Center along with the data/voice circuits. The remote nodes (roadside cabinets) use the same equipment as described in Designs 1 and 2 for the video, data and voice circuits. Equipment changes are at the hubs and the Control Center. Wideband video equipment (FDM) is replaced with video encoders at the hubs which directly feed digital video into the SONET equipment. Video decoders are used at the Control Center.

The SONET OC-12 (622 Mbps) system is sized to transport each video channel at a DS-1 data rate of 1.544 Mbps which provides a full-motion (30 fps) video stream but at reduced quality in comparison to the EIA-250C video standards. As stated earlier, there are a number of video digitizing schemes available now with more on the horizon. Cost is the predominant factor and can easily double the system cost depending on the equipment and video encoding schemes used. A review of the most cost effective digital video scheme will be looked at again in the future should Design 3 be chosen as the desired solution.

For this design, the H.261 standard was selected due to its low cost and wide use in video conferencing applications. It has scalable bandwidth from 64 Kbps to 2.048 Mbps (DS-0 to E-1) with a spatial resolution to 720 x 625 pixels. This scaleability can allow for multiple video signals to be encoded within one DS-1 (1.544 Mbps) data stream. A common scaling factor is 4 video signals at 384 Kbps each being carried on the one DS-1 data stream. Signal quality is lower but more signals can be transported over a bandwidth limited communication system.

It may be difficult to visualize the quality of this type of signal without actually seeing a demonstration. The following is offered as one possible, (perhaps poor) example to help clarify an approximation of the H.261 signal quality at a 1.544 Mbps data rate.

Example: Most users of PC's have their screen resolutions set for the highest possible setting to provide the crispest possible picture and to reduce the jagged edges and block like appearance of objects experienced at lower resolutions (640 x 480 pixels). The nearest PC screen resolution to 720 x 625 for this comparison is 800 x 600 for the typical PC. If you play a full-screen size, streaming video or other video file format on a PC, you will notice an effect where sections of the object being shown appear to have a block like appearance. Disregarding any effect of dropped frames (dependent on PC's processing capability), and assuming the PC can deliver a 30 fps video stream, the signal quality seen approximates an H.261 digitized video stream. As the picture is reduced in size (less than full-screen), the appearance of the picture visually improves.

There are a host of factors that effect picture quality and the above example is only offered to insure that expectations are not beyond what the H.261 video standard can deliver. Other encoding techniques, such as MPEG 2 can offer high quality video that is used by the televison broadcast industry and can use up to 155 Mbps bandwidth per video signal to deliver that level of quality. Lower data rates are available with a subsequent reduction in signal quality. It then becomes a

matter of choosing what is an acceptable and useable level of video quality under various environmental conditions — versus costs.
The same type FO/VT's as used in the previous designs are used to transmit the analog video signal from the camera to the hub. The encoders at the hubs convert the NTSC (analog signal) from the cameras to a digitized signal which is then compressed by the video encoder using the H.261 standard algorithm.

Figure 16 shows the equipment configuration for typical nodes and a hub.

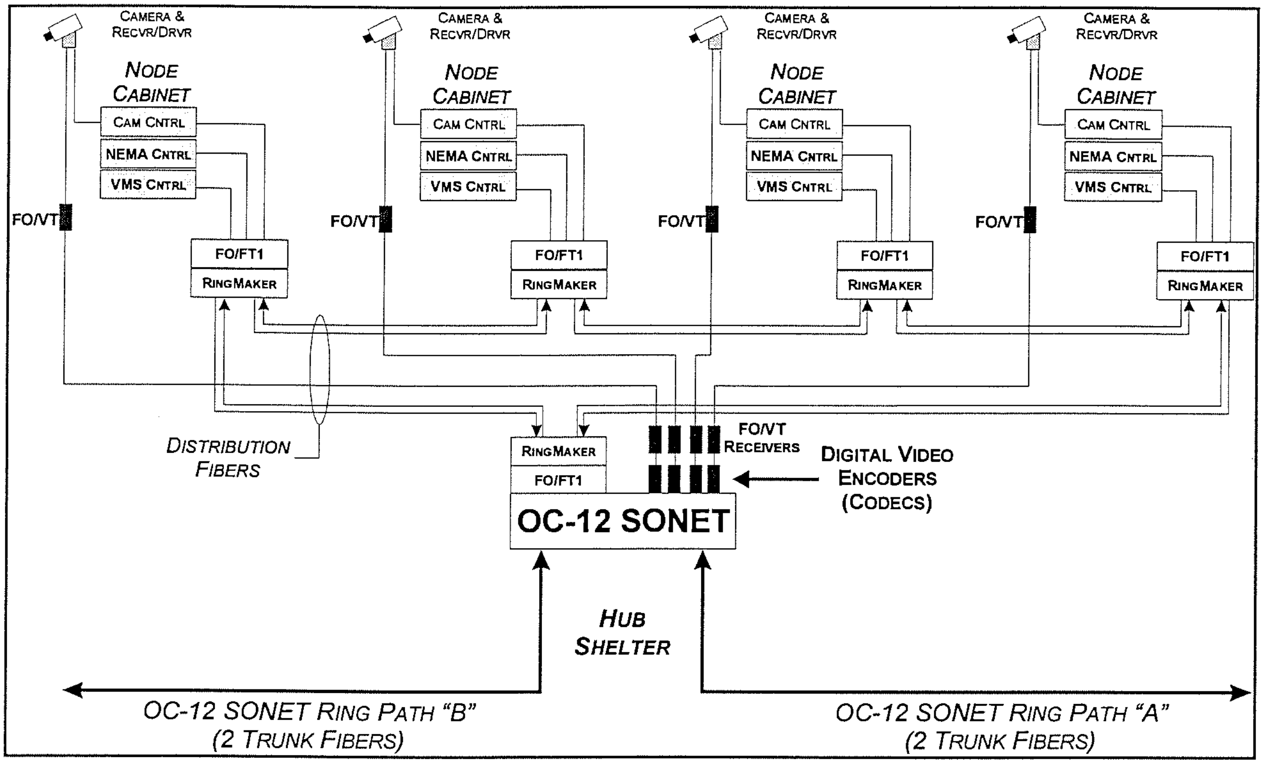


Figure 16

Cameras that digitize the video signal directly are coming on the market but for now they remain highly specialized products and are not considered cost effective for ITS applications. They still require a fiber-optic transmitter/receiver pair to convert the electrical signal to optical in order to transport the video signal via fiber.

At the Control Center, 138 encoded video signals are received by the SONET equipment (+6 direct feeds) and the DS-1 signals are passed to the respective video decoder. The signal is converted back to the NTSC format for distribution by the Video Matrix Switch as shown in Figure 17. This is a 1:1 one relationship for a total of 288 video encoders/decoders units being used in the system.

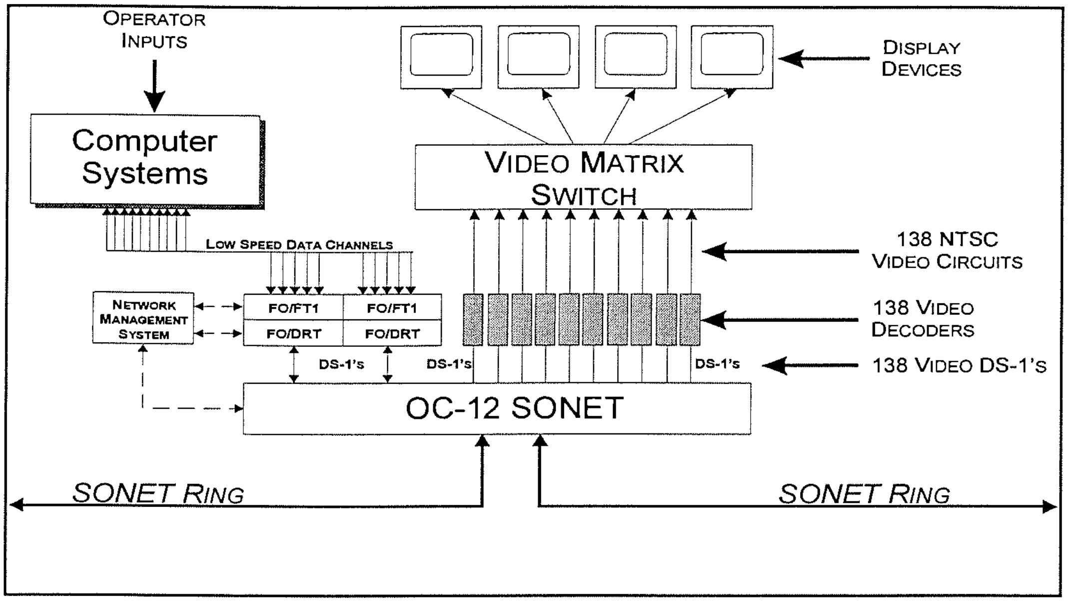


Figure 17

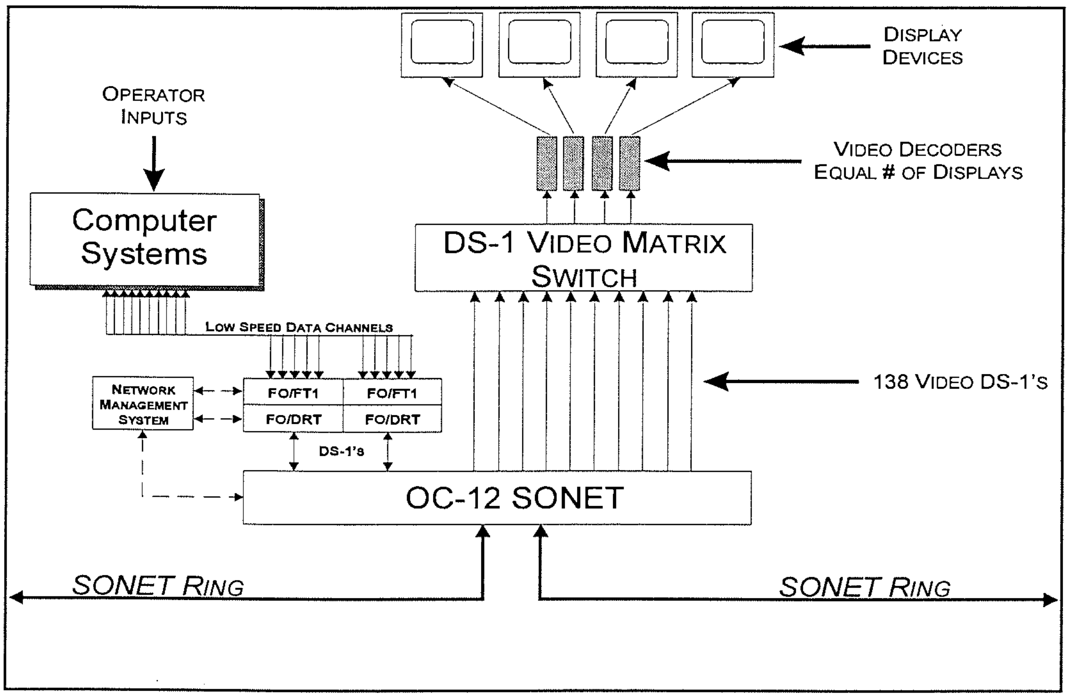


Figure 18

An alternative configuration is shown in Figure 18. This design requires the selection of a Video Matrix Switch that can accept and switch a digital (DS-1 or higher) signal format. Not all video switches can switch digital signals and only accept NTSC and/or other analog signals that are industry standards (PAL, SECAM, S-VHS, etc.).

The number of video decoders is reduced at the Control Center to equal the number of display devices. With a list price of approximately $5,000 per video codec, lowering the number required can be a significant cost savings.

The cost of an analog format video matrix switch versus one that can also switch digital signals is not significantly lower in price and is on the order of only several thousand dollars depending on the vendor selected. Price is more aptly defined by features and options such as programmability, scaleability (max input/output), redundant critical components and built-in management capabilities.

Design 3 - Communications Equipment Quantities and Budgetary Costs

Budgetary costs are based on manufactures list prices for the equipment only and is based on a design for 4 hub locations, 144 nodes and the Control Center. Costs are for the following communications equipment:

Qty	Equipment
149	FO/FT1's (with electrical transceiver)
149	FO/DRT's (with 2 singlemode and 1 electrical transceiver, redundant power supplies)
288	FO/VT's (SM fiber version, video only, simplex)
288	Video Codec Units (144 Encoders, 144 Decoders)
1	Maintenance Hot Line Telephone System (chassis and modules)
1	TeleVue Network Management System (PC, Operating System and NMS software)
5	OC-12 SONET Add Drop Multiplexers (configured with DS-1's required per hub)
1	SONET Network Management System

Design 3 Budgetary Estimate - OC-12 SONET, Digital Video / Data		
Cost Per Hub Plus Node Equipment	Remote Equip	Control Center
Hub 1 (36 Video + OC-12 SONET)	$565 K	
Hub 2 (21 Video + OC-12 SONET)	$347 K	
Hub 3 (36 Video + OC-12 SONET)	$565 K	
Hub 4 (45 Video + OC-12 SONET)	$695 K	
CC (6 Direct + 138 Video + OC-12 SONET)	---	$1.25 M
Sub Totals	**$2.17 M**	**$1.25 M**
System Total	**$3.42 M**	

In the budgetary above, 144 video decoder units are located at the Control Center at a list cost of $5,000 each for a total of $720,000. As explained earlier, reducing the video decoders by using a digital video matrix switch, will significantly lower costs.

Example: If the maximum number of display devices is 48, a reduction of 96 decoders is realized (see Fig 18) and a cost reduction of approximately $480 K can be realized (96 x $5 K = $480 K).

System Comparisons

The following tables highlight some of the Pro's and Con's of each design.

Design 1

Pro's	Con's
1. Lowest cost design - $2.08 M	1. Maximum of 48 wideband video ch's per fiber
2. EIA-250C, high quality, full motion video, 30 fps	2. Data networks limited to DS-1 rate (1.544 Mbps)
3. Industry Standards Compliant	3. Limited Add/Drop capability for video ch's
4. Network Management to channel level on the FDM's, FO/FT1's and FO/DRT's	
5. Counter rotating ring networks for nodes (FO/FT1 & FO/DRT, with 1 DS-1 avail at each sector hub)	
6. Scalable - Up to 63 FO/FT1 nodes per sector	
7. Diverse path routing capability for FDM's	
8. Redundant critical components	
9. Maintenance Hot-Line (Service Voice Link)	
10. Upgrade path to SONET capability	

Design 2

Pro's	Con's
1. Next lowest cost design - $2.11 M	1. Maximum of 48 wideband video ch's per fiber
2. EIA-250C, high quality, full motion video, 30 fps	2. Adds 2nd Network Management System for SONET
3. Industry standards compliant	3. Limited Add/Drop capability for video ch's
4. Network Management to channel level on the FDM's, FO/FT1's and FO/DRT's	4. Bidirectional capability of FDM's deleted to reduce cost of system
5. Counter rotating ring networks for nodes (FO/FT1 & FO/DRT, 4 DS-1's avail at each sector hub, 1 used)	5. Slight increase in system cost
6. Scalable - Up to 63 FO/FT1 nodes per sector	6. Growth of SONET limited to OC-48 using same chassis (vendor dependent)
7. Diverse path routing capability for FDM's	
8. Redundant critical components	
9. Maintenance Hot-Line (Service Voice Link)	
10. Mixed video capability (digital and WB analog)	
11. 84 DS-1's in OC-3 SONET system	
12. Field upgradable to OC-12/48 (vendor dependent)	
13. Adds increased data services capability beyond DS-1 (10 Mb Ethernet, OC-1, DS-3)	

Design 3

Pro's	Con's
1. H.261 standard video (lower cost than MPEG)	1. Highest cost system - $3.42 M
2. Industry standards compliant	2. Adds 2nd Network Management System for SONET
3. Network Management to channel level on the FO/FT1's and FO/DRT's	3. Lower quality video (digitized, compressed) compared to EIA-250C standard
4. Counter rotating ring networks for nodes (FO/FT1 & FO/DRT, many DS-1's can be added at each sector hub, 1 used in design)	4. To obtain higher quality video requires additional bandwidth per video channel
5. Scalable - Up to 63 FO/FT1 nodes per sector	5. Growth of SONET limited to OC-48 using same chassis (vendor dependent)
6. Redundant critical components	
7. Field upgradable to OC-48 (vendor dependent)	
8. Adds increased data services capability beyond DS-1 (10/100 Mb Ethernet, OC-1, DS-3, OC-3)	

9. Maintenance Hot-Line (Service Voice Link)	
10. 336 DS-1's in OC-12 SONET System	

Recommendations and Rational

Design 2 (Wideband Video and SONET) is the recommended system design because it offers the most versatility in features and functionality. With flexibility inherent to the design, it will readily adapt to future needs of this ITS application. The decision to start with an OC-3 (155 Mbps) SONET system and upgrade to an OC-12 (622 Mbps) or OC-48 (2,488 Mbps) later, will depend on any needs for Ethernet LAN's or other data services that may be presently leased from the local Telco which could be assigned to this network.

Cost effectiveness is to be ultimately decided by the reader. Three budgetary proposals have been outlined above to provide a relative cost analysis to aid in that decision. Different system topologies, equipment and quantities of equipment will certainly yield disagreeing system costs. The designs proposed are sufficiently similar in nature and consistent in quantities to provide a valid comparison. As a reminder, the budgetary costs shown are for list prices from the selected vendors 1998 price sheets or budgetary quotes and are subject to change by the vendors. Typical discounts for volume purchases will range from 15% to 40%, depending on the equipment vendor and other contractual requirements. Prices are for equipment only and does not include any other services that may be provided by the manufactures such as training, documentation, additional warranty, shipping/handling, etc.

The choice of using wideband video (FDM's) versus digitized, compressed video is the logical choice when high quality and low cost are the primary drivers. Simply put, digital video is not cost effective at this time for a large scale implementation. To achieve the same quality level as wideband video, digitized video requires enormous amounts of bandwidth which increases the costs of the transmission equipment needed to support the digital video bandwidth requirements.

The counter-rotating ring networks used to connect the nodes to the hubs is one of the most survivable topologies available to insure network availability for the distribution side. The SONET network, on the trunk side, uses similar topology (after system build-out) and adds geographically diverse path routing to provide network survivability for cut cables and/or equipment failures. Redundancy of critical components and protected circuits are built-in capabilities of the selected vendors equipment. Geographically diverse path routing and component redundancy is also integral to the wideband video system and provides the same high degree of protection for these circuits.

As the system expands to eventually include the Alternate ITS Route Plan, the design of this system will accommodate the anticipated equipment interfaces for wireless systems (spread spectrum, cell based systems, microwave, satellite, etc.) plus, Telco provided, leased land-line services. Hubs and nodes can be added at locations along the fiber paths that will accept tie-in's from the public networks and/or to extend the existing network to new locations. Mixed video formats (analog and/or digital) can be accommodated to provide for future cameras that are not within the present scope of this project.

Standards compliance, as stressed in the National ITS Architecture document is the key to successful integration of the systems. The design accounts for and uses the most widely used interface standards in use today for the selected communications equipment.

Management of the network resources is accomplished using comprehensive Network Management Systems that are designed to monitor and control their respective equipment groups and are compatible with the ITS model recommendations.

If the SONET capability is decided not to be an immediate requirement, Design 1 (Wideband Video and DS-1 Digital Data) is the basis of Design 2 minus the SONET network that can be easily upgraded to Design 2 in a future phase. As proposed, it is a fully featured design that will serve this ITS application well into the future.

Design 3 (All Digital Video/Data Over SONET), is a superset of Design 2 which is a significantly more costly system with lower quality video. Digital video technology will eventually stabilize and a dominant standard will evolve that will encourage manufacturers to lower costs and establish the technology in the market place. As noted, the ITS model refers the decision of a digital video standard to the user.