Chapter 4
Corridor Studies

Design Standards

The design standards for the North-South Expressway, as a part of the National Highway System, shall conform to the latest Design Standards for Freeways issued by the Louisiana Department of Transportation and Development. The North-South Expressway shall follow the design standards recommended for rural freeways. A detailed line and grade study which will develop more complete consideration of design features which shall address projected traffic volumes, restricted right-or-way avilable through areas of densely developed residential areas, location of electric transmission lines, major drainage bayous (Twelve Mile Bayou and McCain Creek), and an extensive floodplain area. Table 2 outlines LaDOTD design standards for urban and rural area freeway classification.

See Exhibits Q, R, S, and T for typical roadway and bridge sections used in developing comparative cost estimates of the alternative alignments.

Other than the intersection of the Expressway with I-220, a "diamond" type interchange is noted at each crossing of an existing state or federal highway except at La 2. At "diamond" type interchanges, ramps are generally configured to comply with sight distance and signing requirements and to avoid use of retaining walls at bridge approach fill.

For purposes of this study, the North-South Expressway roadway is shown to be elevated over intersecting roadways, except for some interchanges where topography dictates the connecting state highway to span over the Expressway. Overpass/underpass concept will be fully developed in the Line and Grade Study.

Roadway elevations shall be approximately five (5) feet above the 100 yr. flood elevation noted on FEMA maps. The five (5) feet will allow two feet freeboard, plus one foot clearance between anticipated high water and roadway sub-base, plus thickness of sub-base, base and pavement. Roadway elevations may be adjusted either during the Environmental Impact Study or during the preliminary design phase after a comprehensive in-depth drainage and back-water analysis is conducted to identify 100 year flood stages based upon up-dated conditions. North of La 1, FEMA maps identify a large floodplain area, but does

not show the 100 yr. flood elevation. For purposes of the study, we assume 100 year flood elevation as one (1) foot above natural ground; the roadway is shown to be approximately six (6) feet above the ground line.

All bridge structures, except for the interchange structure at I-220/Expressway, shall be reinforced concrete slab over pre-stressed concrete girders, cast-in-place concrete cap and concrete cast-in-place columns supported by pile foundation. The I-220/Expressway interchange structure may have a superstructure with a combination of steel plate girders, trapezoidal shaped steel girders, and pre-stress concrete girders supporting a reinforced concrete slab. Superstructure shall be supported by flare shaped piers to provide not only an aesthically pleasing pier but also one with structural characteristics necessary for the imposed loads. Piers are considered to be supported by a pile foundation.

Traffic Analysis

A comprehensive traffic analysis was conducted and a report issued with study findings, traffic impacts and benefits associated with the proposed North-South Expressway between Shreveport and the Arkansas State Line.

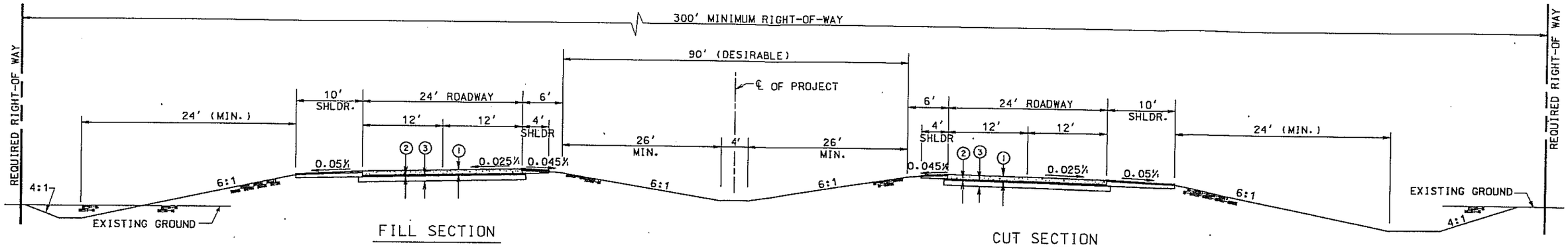
The study reviewed and documented existing transportation conditions, traffic volumes and travel characteristics. Both 48-hour mechanical and 12-hour manual vehicle classification counts were conducted. Future traffic volumes were estimated for year 2005 (estimated year of projected completion) and year 2020 (design year). Traffic impacts were evaluated by comparing future traffic volume projections and various measures of levels-of-service (LOS), vehicle miles and hours of travel, average trip lengths and total vehicle delays.

Full text of Traffic Analysis is included in the Appendix.

TABLE 2
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
DESIGN STANDARDS FOR FREEWAYS

Item No.	Item	F-1	F-2	F-3
1	Design Speed (M.P.H.)	50 (1)	60	70
2	Level of Service	C (2)	C (2)	B (3)
3	Number of Travel Lanes (Minimum)	4	4	4
4	Width of Travel Lanes (ft.)	12	12	12
5	Width of Shoulders (Where Used) (ft.) (A) Outside (B) Median	 10 (4) 6 (5)	 10 (4) 6 (5)	 10 (4) 6 (5)
6	Type of Shoulders	Paved	Paved	Paved
7	Width of Median (ft.) (A) Depressed (B) Continuous Barrier (4 Lane) Continuous Barrier (6 Lane)	 50 (Min.) 14 (6) 26 (6)	 60 (Min.)-90(Des.) 14 (6) 26 (6)	 60(Min.)90(Des.) 14 (6) 26 (6)
8	Fore Slope - Ratio	4:1(Min.)-6(Des.)	6:1	6:1
9	Back Slope - Ratio	4:1	4:1	4:1
10	Pavement Cross Slope (ft. per ft.)	0.025 (7)	0.025 (7)	0.025 (7)
11	Stopping Sight Distance (ft.)	400-475 (8)	525-650 (8)	625-850 (8)
12	Maximum Superelevation (ft. per ft.)	0.10	0.10	0.10
13	Maximum Horizontal Curvature	8°	5°	3°
14	Maximum Grade %	4 (9)	3 (9)	3 (9)
15	Minimum Vertical Clearance (ft.)	16 (10)	16 (10)	16 (10)
16	Width of Right of Way (ft.) (A) Depressed Median (B) Median Barrier (C) Minimum From Edge of Bridge Structure	 As Needed As Needed 15-20	 300 As Needed 15-20	 300 As Needed 15-20
17	Bridge Design Load	HS-20	HS-20	HS-20
18	Width of Bridges (Minimum) (Face to Face Bridge Rail)	64'	64'	64'
19	Guardrail Required at Bridge Ends	Yes	Yes	Yes
20	Horizontal Clearance (ft.) From Edge of Travel Lane) (A) 4:1 Foreslope (B) 6:1 Foreslope	 30 22	 N/A 32	 N/A 34

(1) For use in Urban Areas Only.
(2) Level of Service D Permissible For Heavily Developed Urban Areas.
(3) Level of Service C Permissible For Urban Conditions and Auxiliary Facilities in Rural Areas.
(4) 12 Paved Required With Truck DDHV Greater Than 250.
(5) 4' To Be Paved--10 To Be Paved On 6 Lane Facilities--12 To Be Paved on 6 Lane Facilities with Truck DDHV Greater Than 250.
(6) 32 Maximum.
(7) 2% Permissible For Rehabilitation Projects.
(8) Minimum Values Shown Permissible For Rehabilitation Projects.
Maximum Values Shown To Be Used Where Conditions Permit.
(9) Grades 1% Higher May Be Used In Special Cases.
(10) 6" Additional To Allow For Future Surfacing--17 Required For Trusses and Pedestrian Overpasses.
(11) It May Be Necessary To Flatten The Degree Of Curve And/Or Increase The Shoulder Width (Maximum Of 12') To Provide Adequate Stopping Sight Distance On Structure.



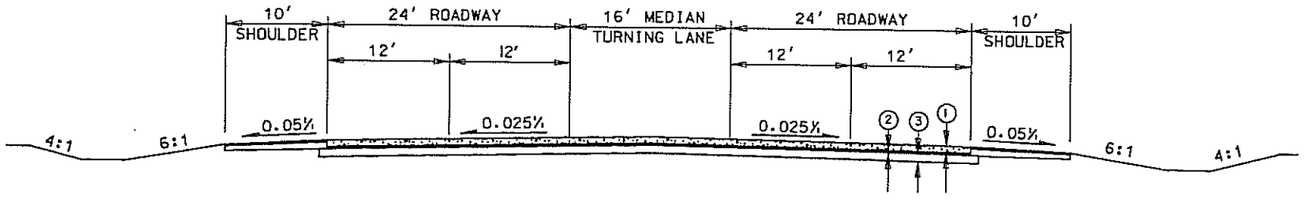
FILL SECTION

CUT SECTION

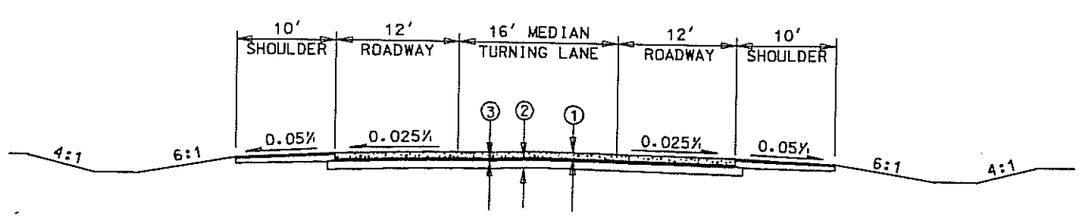
TYPICAL EXPRESSWAY SECTION

N.T.S.
DESIGN SPEED: 70 M.P.H.

① PAVEMENT STRUCTURE
② PAVEMENT STRUCTURE
③ PAVEMENT STRUCTURE
④ SHOULDER PAVEMENT
⑤ SHOULDER PAVEMENT



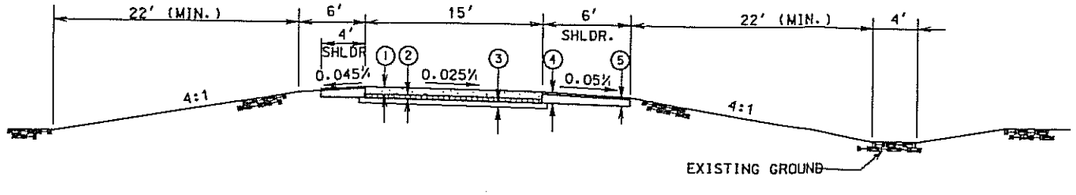
4 LANE ROADWAY



2 LANE ROADWAY

TYPICAL CONNECTING ROADWAY SECTIONS WITHIN EXPRESSWAY INTERCHANGE

N.T.S.



TYPICAL INTERCHANGE RAMP SECTION

N.T.S.

EXHIBIT Q
TYPICAL ROADWAY SECTIONS

NORTH-SOUTH EXPRESSWAY
I-220 TO ARKANSAS STATE LINE
STATE PROJECT NO. 700-24-0072
FEDERAL AID PROJECT NO. DE-NHS-0009 (801)
CADDO PARISH

DEMOPULOS AND FERGUSON, INC.
CONSULTING ENGINEERS

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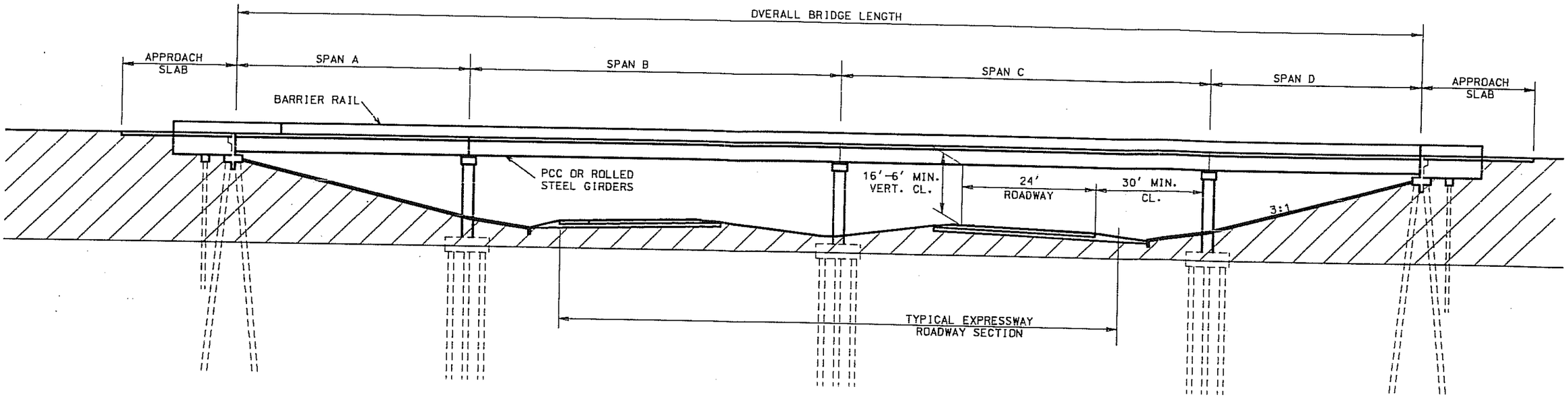
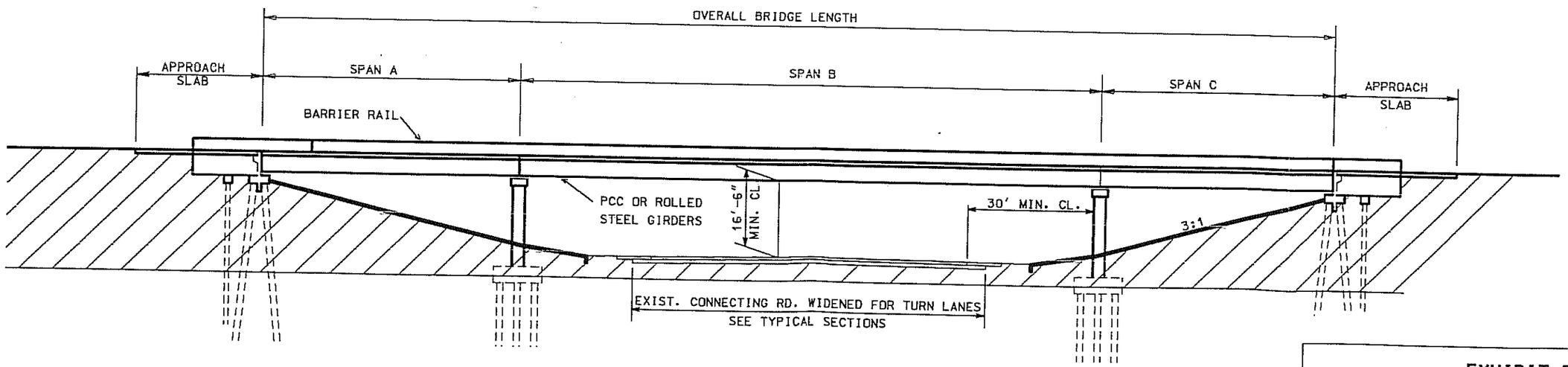


TYPICAL BRIDGE ELEVATION FOR ELEVATED CROSS ROAD

N.T.S.



TYPICAL BRIDGE ELEVATION FOR ELEVATED EXPRESSWAY

N.T.S.

EXHIBIT R
TYPICAL BRIDGE ELEVATIONS

NORTH-SOUTH EXPRESSWAY
I-220 TO ARKANSAS STATE LINE
STATE PROJECT NO. 700-24-0072
FEDERAL AID PROJECT NO. DE-NHS-0009 (801)
CADDO PARISH

DEMOPULOS AND FERGUSON, INC.
CONSULTING ENGINEERS

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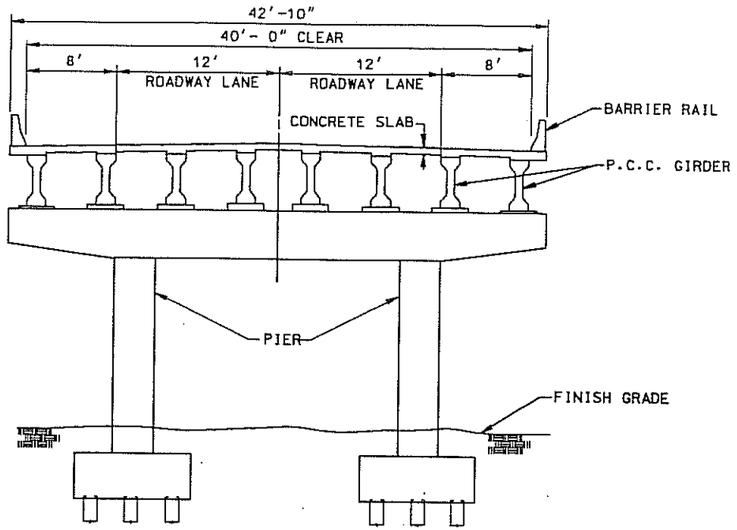
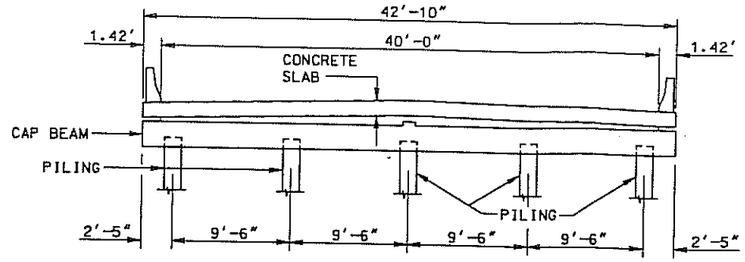


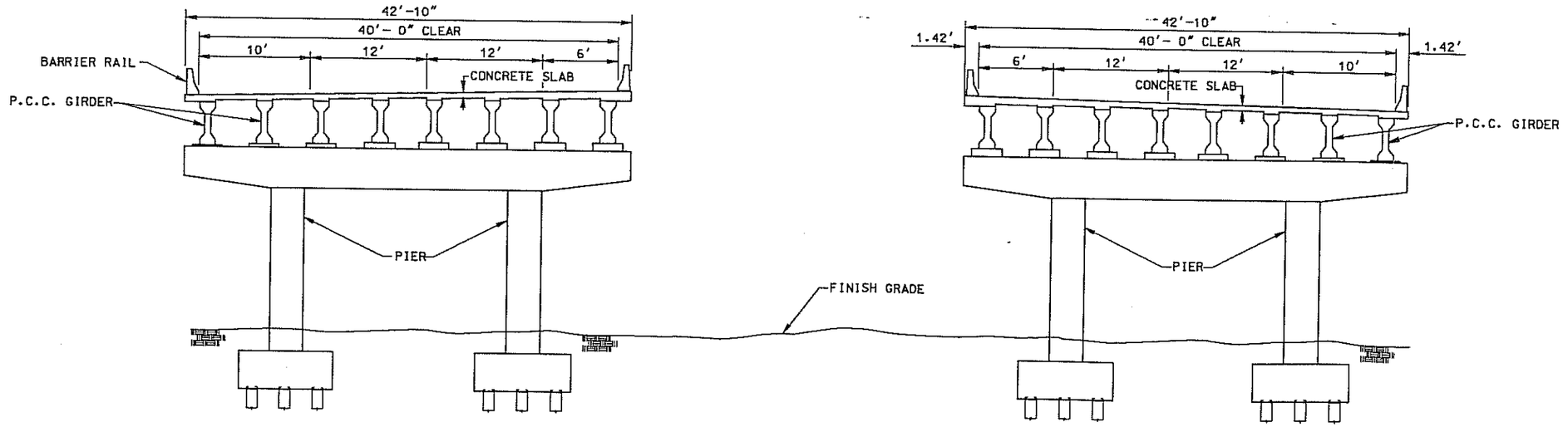
TYPICAL BRIDGE BENT FOR CROSS ROAD

N.T.S.



TYPICAL SLAB SPAN FOR STREAM CROSSING

N.T.S.



TYPICAL BRIDGE BENT FOR EXPRESSWAY

N.T.S.

NOTE: SEE EXHIBITS FOR ALTERNATE BRIDGE SECTIONS SHOWING STEEL GIRDERS.

EXHIBIT T
TYPICAL BRIDGE SECTIONS

NORTH-SOUTH EXPRESSWAY
I-220 TO ARKANSAS STATE LINE
STATE PROJECT NO. 700-24-0072
FEDERAL AID PROJECT NO. DE-NHS-0009 (801)
CADDO PARISH

DEMOPULOS AND FERGUSON, INC.
CONSULTING ENGINEERS

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Conceptual Line and Grade

Description of Alternative Alignments

Alternative alignments developed for study purposes were governed by two key location considerations. One was the location of the roadway at the Louisiana-Arkansas state line which is determined by an Environmental Impact Study directed by the Arkansas State Highway and Transportation Department. The other key location is the intersection of the proposed Expressway with I-220; this location is approximately at mid-distance between I-220 interchange with US 71/La 1 and with La 173.

Initially three locations were under consideration; these are identified as Alternates B, C and E; see Exhibit B-2. At the Arkansas state line, Alternate B is approximately 6000 feet west of US 71, Alternate C is approximately one and one-half (1-½) miles east of US 71, and Alternate E is approximately 3000 feet west of US 71. In January, 1995, the Arkansas State Highway and Transportation Department selected Alternative E as the "technically preferred" alignment. The Arkansas "technically preferred" alternate is being developed in the Final Environmental Impact Statement (FEIS); which has not yet been approved as of Novemeber 1, 1995. The Arkansas draft Final Environmental Impact Study states:

> "The southern section [approximately 6.4 kilometers (4 miles)] of the preferred alternative will be constructed after the Louisiana location is determined. Construction south of Doddridge will not occur before a decision is made on the new location upgrade of US 71 in Louisiana. This terminus in Arkansas will preclude any foreclosure of alternative in Louisiana."

Future Line and Grade Study should evaluate any location which is reasonably close to Corridors B and E at the state line and will fit the overall desire to accomodate an alignment in Louisiana and in Arkansas which will mutually be acceptable to both states.

See Exhibit B-3 for alignment of Alternatives B, C and E based upon the "technically preferred alignment" and I-220 location.

A major concern was the roadway alignments between I-220 and La 1 since this area was heavily populated and developed with residences, schools and churches. McCain Creek and the associated

floodplain within the study area limits the opportunity for only one roadway alignment which would provide minimum relocation and social disruption. Floodplain concerns associated with an alignment can be mitigated to address drainage and backwater requirements.

Alternate C

Alternate C starts at the intersection with I-220 which is defined as a full four way interchange as required for the intersection of two interstate type highways. Alternate C continues northerly on the west side of McCain Creek to intersect with Martin Luther King Drive (La 3194). A "diamond" type interchange at Martin Luther King Drive (MLK) configured to minimize relocation of residences will provide local access to the proposed Expressway.

Alternate C turns easterly, crosses over McCain Creek to avoid a residential development and then turns and continues northeasterly along the east side of McCain Creek, crosses over Pine Hills Road (no interchange) and turns northerly toward La 1. A "diamond" type interchange will be provided at the La 1 interchange with the Expressway bridging over La 1. La 1 shall be improved to provide left turn lanes to both northbound and southbound access ramps. This type of interchange shall be a typical configuration for almost all interchanges with state highways and US 71. This portion of Alternate C between I-220 and La 1 is common to Alternates B and E.

Alternate C continues northerly approximately two miles until its intersection with a major electric power line transmission easement. The roadway will then continue parallel and adjacent to the power line easements. A typical "diamond" type interchange is provided at the intersection of Alternate C with La 173, La 169 and La 530. North of La 530 the roadway alignment veers to the east and continues northerly to intersect with La 170 approximately 2500 feet west of US 71 with a "diamond" type interchange. Alternative C then veers east to cross US 71 approximately half way between Gilliam and Hosston, and then turns northerly to an interchange at LA 2 located approximately 1.25 miles east of US 71. Alternative C continues northerly to a point east of Mira, then turns westerly to an interchange with US 71 approximately half way between Mira and Ida. Alternative C turns northerly to follow Alignment E which connects with the preferred highway location approximately 3000 feet west of US 71 at the Louisiana-Arkansas state line.

Alternate C is approximately 36.06 miles in length.

Alternate E

Alternate E begins immediately north of Alternate C interchange with La 1, veers to the northwest, crosses Twelve Mile Bayou and intersects La 173 approximately 2.25 miles west of US 71 with a "diamond" type interchange, continues northerly intersecting La 169, La 530 and La 170 between 1.75 miles and 2.75 miles west of US 71; each intersection will have a diamond interchange. Alternate E continues northerly to a "one-side" interchange with La 2 west of US 71 between the Black Bayou dam and a major electric power line transmission easement. The roadway location north of La 2 will require minor residential relocation, but will not negatively impact the Noah Tyson Park on Black Bayou; see Exhibit K, Parks. Alternate E continues northerly with an interchange at La 769 approximately 3000 feet west of Mira, an interchange at La 168 approximately 3000 feet west of Ida and continues northerly to connect with Alternate E at the Louisiana-Arkansas state line.

The alignment composed of Alternate C between I-220 and La 1 plus Alternate E is approximately 35.71 miles in length.

Alternate B

Alternate B alignment was configured to be closer to La 1 to provide easier access to the proposed Expressway for Rodessa, Vivian and Oil City, since these communities represent the major population concentrations for North Caddo Parish. Alternate B connects to Alternate E approximately one mile north of the interchange at La 169, veers northwest to a proposed interchange with La 530 approximately 1.75 miles east of La 1. An interchange is located on La 2 approximately 1.5 miles east of La 1; an interchange was not provided for La 170 since La 2 is the major roadway connecting Vivian to US 71. Alternate B continues northerly, crosses Black Bayou to an interchange with La 769, then veers northeasterly to interchange with La 168 east of Ida and then connects with Alternate E at the Louisiana-Arkansas state line.

The alignment comprised of Alternate C between I-220 and La 1, portions of Alternate E and Alternate B is approximately 38.48 miles in length.

Links

"Links" or alternative sub-alignments linking Alternatives B and E are shown on Exhibit B-3. These "links" identify possible roadway alignments which may connect the best segments of the major

alternatives, thereby, bringing together the best feature of each alternative for a workable and acceptable solution for a roadway alignment within the study limits. These "links", as well as any other "links", which may be identified, shall be examined during the Environmental Impact Study in conjunction with Alternatives B,E and C to effectively identify an overall preferred highway alignment between I-220 and the Arkansas state line.

Potential Environmental Impacts

Air Quality

The construction of the North-South Expressway would have two short-term construction related effects on air quality: an increase in emissions caused by heavy construction equipment, and an increase in dust associated with earth moving operations.

The increased particulate matter levels will be the largest component of the air quality impact from construction and the greatest annoyance to residents near the construction site. Dust emissions will vary daily depending on the level of activity, specific operations, and weather conditions. Most emissions result from equipment traffic over temporary roads at the construction site. Dust emissions from the site will be directly affected by the size of the disturbed area, vehicle speeds, silt content of the soil, and the surface moisture of the temporary road.

The most common dust control techniques involve watering and construction vehicle speed reduction. Construction vehicles in the work area normally travel at relatively slow speeds. The best method for dust control would be a combination of these techniques: watering would be employed, and vehicle speeds would be kept to a minimum.

All construction would be in accordance with state and local laws and regulations pertaining to the minimization of the effect of construction on air quality.

Noise

The Noise Abatement Criteria (NAC) of the Federal Highway Administration (23 CFR 772) provides a maximum noise level (in decibels) for various land use categories. Noise sensitive areas were

verified by field surveys. Residential and non-residential buildings sensitive to noise such as schools, hospitals, parks, and churches were located and identified on Exhibits J,K,L and N.

Rural areas with scattered residential and commercial dwellings can be expected to have existing background noise levels which are very low. Those areas that have higher density residential/commercial developments along existing roads, which are known to carry higher traffic volumes, can be expected to already be exposed to somewhat higher noise levels. Prior to construction related activities, existing noise levels, projected noise levels, and, if necessary, noise abatement options should be evaluated.

Noise associated with construction projects can result in a high degree of annoyance to individuals and groups, and this can be a concern to communities affected. Due to the rural nature of the corridor, there are few locations that would experience adverse noise related impacts due to construction activities. These locations would be affected for a limited time.

Noise associated with roadway construction would be generated by the following operations:

- Excavation
- Erection of structures
- Clearing and grubbing
- Placing of foundations
- Finishing operations (i.e., filling, grading, paving, and cleanup)

Control of construction noise levels can be achieved by scheduling the work during normal working hours. The contractor should also be required to comply with the Occupational Safety and Health Administration (OSHA) regulations and Louisiana Department of Transportation Standards concerning noise attenuation devices on construction equipment.

Construction of the proposed facility will impact noise and air quality and can be assumed to have an effect if the facility is not of sufficient distance from sensitive receptors. Further studies should be conducted to determine locations and levels of predicted effects and potential mitigation measures.

Wetlands

The majority of the wetlands possibly impacted by the construction of the North-South Expressway could include Caddo Lake, Soda Lake Wildlife Management Area, Black Bayou Lake, small stream crossings, and associated floodplain forests. In some areas, highway improvements could occur within existing rights-of-way; therefore, affecting previously disturbed systems. However, the majority of the extension will occur in areas where the roadway will be on new alignment. The areas of new alignment will result in the most severe impacts to wetland habitat, due to the clearing of presently undisturbed systems.

Avoidance of wetland areas would be the preferred construction method; however, if this is not possible, then minimization of impacted areas would need to be pursued. One method of minimizing impacts would be the placement of roadway on structure rather than fill. Advantages of this measure over planned embankment construction include: reduced right-of-way requirements, unrestricted movement of animals, minimum redirection of freshwater flow and runoff, no disruption of groundwater flow, and no loss of freshwater storage or lowering of the water table.

The extent and magnitude of impacts to wetland areas will depend on final alignment and the construction techniques selected. Even if Federal funds are not used for this project, impacts to wetlands will require a U.S. Army, Corps of Engineers 404 permit. The potential also exists that the Corps, as part of their permit review process, could recommend an Environmental Assessment or Environmental Impace Statement be prepared. The recommendation would be based on the amount and quality of wetlands affected.

Water Quality and Scenic Streams

Impacts to water quality are expected to be potentially greatest in those areas of construction associated with streams and floodplain crossings. The long-term impact to these systems could be from vehicular-related pollutants associated with highway stormwater runoff. Temporary impacts related to bridge construction and land clearing operations are possible. Long-term cumulative effects can occur if appropriate Best Management Practices are not incorporated into design plans. These long-term effects include: an increase in nutrient levels, suspended solids, and pathogenic organisms; a decrease in aesthetics; and the introduction of toxic materials such as pesticides and heavy metals into the substrate. It has been determined that the proposed action is not within the channel or floodplain of any state designated scenic stream or natural resource water.

Floral and Faunal Communities

The proposed project can be expected to directly impact natural vegetation and wildlife during the construction and operation phases. However, indirect impacts are also potentially damaging. Potential impacts are subject to mitigation through planning and design consideration and by implementation of appropriate measures during construction. When impacts cannot be adequately mitigated through planning, design, and field implementation of construction techniques, alternative measures, such as compensation, may be necessary.

Construction impacts result from disturbance of the surface from such activities as removal of surficial materials; compaction from heavy equipment and construction crews; erosion; siltation; spillage of fuels, lubricants, and other toxic liquids; and a temporary increase in noise, dust, and air pollutants. Construction impacts also include construction activities necessary for relocation of utilities, roadways, railroads, and other structures.

Operational impacts are those attributable to maintenance activities and usage of the highway corridor and occur after completion of construction. Operational impacts include: emission of air pollutants by vehicles; spillage and dispersion of fuels, lubricants, and other toxic liquids; and destruction of wildlife by vehicular collisions and machines used in highway right-of-way maintenance.

Indirect impacts are those attributable to the project as a factor in the stimulation and/or acceleration of urban and industrial expansion along the corridor. These impacts may occur over time and, realistically, can only be mitigated by community planning through effective zoning and ordinances.

The major direct impact on vegetation results from preparation of the right-of-way for construction. All surfaces on which construction will occur are traditionally cleared, and plant materials are usually windrowed and burned on-site.

Habitat destruction accounts for the greatest impact to wildlife species during construction. Those species residing in the path of construction will be displaced into adjoining habitat. This will place additional stress on remaining habitat to support existing populations plus the newly displaced individuals. This displacement results in competition for suitable habitat, food, and den (or nest) sites remaining on adjacent lands, and an increased mortality resulting from the loss of resources.

Listed Species of Concern and Critical Habitat

Species listed by the U.S. Fish and Wildlife Service and the Louisiana Natural Heritage Program, which could potentially occur within the corridor study area, are shown in Table 1. No listed species were observed during field surveys, and none are expected to be affected by the proposed project. No federally designated critical habitat will be impacted, due to the absence of such areas along the corridor.

If federally designated threatened and endangered species are encountered prior to, or during construction, then the U.S. Fish and Wildlife Service will be notified. Notification is required under Section 7 of the Endangered Species Act and must occur if federally listed species are encountered.

Archaeological and Historical Sites

Several archaeological sites have been recorded in and around Shreveport; however, these areas should not be affected by the proposed project. A detailed archaeological investigation should be conducted along the alignment or alignments chosen prior to the initiation of construction related activities. This would reduce the possibility of construction delays associated with a previously undiscovered archaeological find.

Hazardous and Solid Waste Sites

A known site search was conducted for the project corridor to identify hazardous waste sites, solid waste sites, and underground storage tank locations. Hazardous waste sites are regulated by both the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

Numerous underground storage tanks and two solid waste sites were located and their approximate locations have been identified on the USGS quads. A thorough investigation should be conducted along the preferred alternative prior to construction related activities. This would aid in identifying previously undiscovered sites.

Solid waste and other hazardous waste materials should be avoided if possible. If avoidance is not a viable alternative, hazardous materials will be tested and removed and/or treated in accordance with

Environmental Protection Agency (EPA) and Louisiana Department of Environmental Quality (LDEQ) regulations.

Prime Farmland

The majority of the soils encountered along the eastern portion of the corridor are prime farmland soils. Consideration should be given to avoiding bisecting large tracts of land (i.e. timber, pasture, cropland, etc.) and possible isolating or alienating usable agricultural properties.

Oil, Gas, and Lignite Resources

A number of oil and gas fields are located within the study limits. These include the Caddo-Pine Island, Hosston, and the Rodessa Oil and Gas Fields.

Several of the proposed North-South Expressway Corridor alternatives may traverse the above mentioned oil and gas fields. The proposed project should not severely impact these areas since earthwork will be limited to the ground surface.

Project Costs

Project costs include cost for construction, right-of-way acquisition, engineering, surveying, soil boring, material testings, construction observation, and administrative/management.

Project construction costs are based upon the 1994, 4th Quarter, Weighted Averages prepared by Louisiana Department of Transportation and Development. Construction cost is based upon the roadway profile, (1" = 1000' scale), bridge structures, interchange ramps and connecting highway improvements within the interchange and other existing roadway and bayou realignment requirements.

Right-of-way acquisition costs were based upon:

- an estimate of average acreage values,
- approximate number of structures within proposed right-of-way, relocation and administrative costs.

Surveying, engineering and administrative and/or engineering management costs were calculated on the basis of 15% of the construction cost estimate.

TABLE 3

ESTIMATE OF PROBABLE PROJECT COSTS

Description	Alternate B 61.96 k(38.48 mi.)	Alternate C 58.07 k (36.06 mi.)	Alternate E 57.50 k (35.71 mi.)
Construction	$ 208,500,000	$ 166,800,000	$ 191,900,000
Right-of-way	12,750,000	12,600,000	12,750,000
Surveying, Engineering, Administrative/Management	31,275,000	25,000,000	28,800,000
PROJECT TOTAL COST	$ 252,525,000	$ 204,400,000	$ 233,450,000
COST PER MILE	6,562,500	5,668,330	6,537,384
COST PER KILOMETER	4,075,613	3,519,890	4,060,000