HARRIS COUNTY
PUBLIC INFRASTRUCTURE
ENGINEERING DIVISION

GUIDELINES FOR ENGINEERS
HAVING ENGINEERING CONTRACTS
WITH HARRIS COUNTY, TEXAS FOR THE
DESIGN OF ROADS AND BRIDGES
AND THE PREPARATION OF
PLANS AND SPECIFICATIONS

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GUIDELINES FOR ENGINEERS HAVING ENGINEERING CONTRACTS WITH Harris County, TEXAS FOR THE DESIGN OF ROADS AND BRIDGES AND THE PREPARATION OF PLANS AND SPECIFICATIONS

Revised August, 1988

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These guidelines currently under review. AS 75/99
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Presented herewith are the design guidelines for engineers having engineering contracts for the design of roads and bridges for Harris County. In general, these roads will be major thoroughfares. Consequently, these guidelines do not address the design of roads and bridges within subdivisions.

Where waterlines and sanitary sewers are a part of the design of the road, they shall be designed in accordance with the "General Design Requirements for Sanitary Sewers, Storm Sewers, Waterlines and Paving" as prepared by the Department of Public Works of the City of Houston.

These design guidelines for the design of paving require that the pavement design be done by a Geotechnical Engineer, using test results provided by a soils testing laboratory, from the examination of existing soils encountered at the depth of the proposed pavement subgrade. Pavement design shall be based on the latest revision of the "AASHTO Guide for Design of Pavement Structures". A minimum pavement thickness has not been designated in these guidelines. Therefore, the pavement thickness proposed by the Engineer shall be supported by a design analysis. This requirement is for all pavement design, whether for flexible base, semi-rigid or rigid pavements.

In computing drainage runoff, a maximum 150-foot wide strip each side of and adjacent to the proposed road right-of-way, except for developed areas drained elsewhere, shall be considered as commercially developed surface contributing runoff to the roadway. The contributing runoff from all contributing areas outside the 150-foot wide strip shall be computed in accordance with their present existing characteristics as outlined by these guidelines. Where the area to be considered is outside the 150-foot wide strip, a preliminary report shall be submitted to the County Engineer as to why it is included in the drainage area.

Where the area to be considered is outside the 150-foot wide strip, an explanation as to why it is included in the drainage area shall be included in the preliminary report submitted to the County Engineer.
SECTION I
PRELIMINARY REPORT REQUIREMENTS
SECTION I
PRELIMINARY REPORT REQUIREMENTS

When an Engineer has a contract to prepare a Preliminary Engineering Report for Harris County, he shall follow the guidelines outlined below for the preparation of the report.

It is within this phase of the engineering contract that the Engineer should make every effort to explore all possibilities, conflicts and alternate solutions with associated costs and make his recommendations as to the most practical way of solving the assignment. During this research, the Engineer must analyze all facets of the project considering the specific requirements outlined in Sections II through XI and present his findings in an organized manner such that the County can make the required decisions with all the facts available.

The arrangement of the report should be as follows:

The first part of the report should outline the authorization for the project, the location and description of the project and the purpose and scope of the project. The second part should outline the conclusions and recommendations for the design of the project, mentioning the alternatives available to the County. The third part should be the cost estimate for the project. The balance of the report should contain the discussion and exhibit and would comprise 95 percent of the bulk of the report. The discussion should address all phases and phasing of the proposed construction, outlining just why certain alternatives were chosen over others and resolving all conflicts associated with the project. The exhibit should contain plats, maps, drawings, sketches and a set of proposed engineering drawings at a reduced but legible scale.

The following is typical information usually found in a Harris County Preliminary Engineering Report:

-Limit of project and authorization (P.O., Bond Year, etc.)

-Description of typical section, number and type of bridges, outfall storm sewers, etc.

-(Topographic and Geologic) faulting, general soils information, vegetation, average land slope throughout project, existing roadway information.

-Restate Harris County requirements per these Engineering Guidelines. Harris County Flood Control requirements as related to design of the drainage system pertaining to the project.
- For the drainage design, define the limits of drainage area and break up into sub-areas. Include drainage area calculations and storm sewer sizes of main trunks. Show location of discharge. Show the type and spacing of inlets. A plotted hydraulic gradient is also required on plan and profile sheets.

- In preparing the definitive construction cost estimate, use typical bid item breakdown from similar previous projects. Provide estimated engineering costs. The engineering costs pertain to those performed in the actual construction of the project and are not an estimate of the engineering costs for the design phase of the project. Do not provide right-of-way and utility adjustment costs in the construction estimate.

- Where required by contract, provide general alignment drawings showing existing and proposed right-of-way. Provide an estimated cost of proposed right-of-way acquisitions identifying any necessary construction easements. The right-of-way acquisition cost estimate shall be prepared by the Engineer based on the best available information.

- Utilities and pipelines shall be located in plan and profile, including existing easements. Provide estimated cost of utility adjustments.

- Provide typical striping and button details. Based on A.D.T. information, provide recommendations for any intersections that will require signalization, or modifications of an existing signal.

- Provide an attached copy of the soils report for this project (to be paid for by Harris County).

- In the section on design recommendations, expand on the pavement design (beyond that in the soils report) describing thickness of each layer and materials of construction (including reinforcing, if concrete), type of subgrade treatment with depth and percent of lime, flyash or combination of, or cement as specified, typical sections on roadway, ditches and outfalls, storm sewer bedding and backfill recommendations. Bridges require type, span number and lengths, substructure limits and type, width, 100 year flood elevation and bottom chord elevation, existing and ultimate channel dimensions and limits and sections of any channel excavation. Define channel slope protection, where required.

- Drawings shall be prepared at 1:20 horizontal and 1:2 vertical scale for plan/profile sheets, vicinity map, drainage map, typical sections and layout of major project items. Drawings may be reduced to 11" x 17".

The following should be used as a guideline for the contents of a Preliminary Engineering Report:

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GENERAL:

a. Report must contain a layout of plan with a profile.

b. Report must show limits of project and its location.

c. Must contain typical design cross-sections.

d. Report must contain the soils report, with its recommendations.

e. Report must show all pipelines and utilities, along with sizes, locations, limits within rights-of-way, elevations and names of Owner, with their address and telephone number. The report shall indicate the location of existing and proposed rights-of-way.

PAVING

a. Report must show limits of paving.

b. Typical section must indicate relative elevation of roadway versus natural ground at right-of-way.

c. Show plan and profiles of intersecting streets and driveways, to commercial establishments, indicating smooth transitions.

d. List the constants, verified in the geotechnical report, used in the AASHTO design procedures.

e. Indicate spacing of expansion construction and contraction joints.

f. Size reinforcing, using grade 40 deformed reinforcing bars, using the subgrade drag equation and size load transfer devices, giving spacing and lengths.

g. Indicate horizontal curve data on all sheets that show a horizontal curve in plan view.

h. Included within the report shall be the engineering calculations which support the recommendations for paving thickness.

DRAINAGE

a. Include drainage area maps to include a 150-foot strip either/both side of proposed roadway limits plus other areas contributing to the drainage. A written explanation shall be included as to why the areas outside the 150-foot strip were included in the drainage area. Existing contours, throughout all drainage areas, shall be shown on the drainage area maps.
b. Match tops of pipe where possible, and numerically or in profile include a hydraulic gradient with a profile of the storm sewer.

c. Show location of drainage conduits using stations and offsets.

d. Show type, station and offset of manholes and inlets with inlet elevations.

DRAWINGS

a. A North arrow must be shown on each drawing indicating a plan view pointing to the right or top of sheet.

b. Existing and proposed right-of-way lines must be shown.

c. Existing roads, drainage facilities, utilities, power poles, buildings, etc. within the proposed right-of-way must be shown on the drawings.

d. All existing major item locations on the drawings shall be indicated by station and offset.

e. The preliminary profiles shall show locations of existing pipe, centerline of road profile, ditch flowline and elevation of natural ground at the R.O.W.'s.

f. The preliminary profiles shall show proposed roadway centerline or outside top of curb elevations, manholes, inlets, outfall structures, flowlines and top of storm sewer, locations of utility pipeline and adjustments required.

g. For drawings contained in the Preliminary Engineering Report, plan scale shall be 1" = 20'. Profiles scales shall be 1" = 20' horizontal and a vertical profile scale shall cover the limits of elevation changes throughout the project. The preferred vertical scale is 1" = 2'. Drawings may be reduced.

h. Match lines should be on the drawings, indicating stations and appropriate drawings for continuation of project.

i. FEMA has established bench marks on County bridges, culverts and etc. Where these bench marks are to be relocated during construction, they shall be so identified in the report.

The following is the suggested outline of a typical report for a bridge only project:

1. Introduction
The following is the suggested outline of a typical report for a road and bridge project:

1. Introduction
2. Purpose and Scope
3. Project Location and History
4. Design Criteria
5. Suggested Construction Phasing
6. Property Ownership
7. Recommendations and Design
8. Cost Analysis
9. Project Cost Estimate
10. Exhibits
   - Cover Sheet with Vicinity Map
   - Land Use Map
   - Overall Sheet Layout and Index
   - Drainage Area Map
   - Typical Cross-sections and Phasing
   - Plan and Profile Sheets with Soils Borings Shown
   - Other Drawings Required by these Guidelines

11. Appendices
   - Geotechnical Investigations
   - Engineering References
SECTION II
BRIDGE DESIGN REQUIREMENTS
SECTION II
BRIDGE DESIGN REQUIREMENTS

1. All bridges are to be designed to a minimum AASHTO H20 or HS-20 load design. Designs are to be in accordance with the latest edition of the "Standard Specifications for Highway Bridges", as adopted by AASHTO.

2. Bridge Widths:
   a. Where there are no curbs on the approach pavements the width of bridge, face to face of curbs, is to be equal to the out to out distance of the approaching road pavement plus four feet, plus the width of walks.
   b. Individual one way traffic bridges on esplanade boulevards shall have one 6-foot clear width sidewalk on the outside and a 2-foot clear width curb on the inside. Two way traffic bridges shall have a 6-foot wide sidewalk on each side.
   c. Where curbs are on the approach pavement, the width of bridge face to face of curbs is to be the same as the distance between curb faces on the approach road.
   d. Bridges of width covered by (a) above, are to have 4-foot clear width sidewalks. Bridges of width covered by (c) above, are to have 6-foot clear width sidewalks.

3. All bridges are to be constructed of reinforced concrete, unless specific applications require other materials, and then only with the prior approval of the County Engineer.

4. Bridge railings are to be Harris County standard railings on reinforced concrete parapets. The Harris County Engineering Department has standard drawings for three types of guardrail. These are pedestrian rail, traffic rail, and combination pedestrian and traffic rail.

5. Each bridge shall have one bronze or aluminum plaque mounted thereon in accordance with the standard drawing obtainable from the Harris County Engineering Department.

6. Where applicable, the following items should be addressed in the design of bridges:
   a. Show a typical section through the bridge.
   b. Show number of bridges and show station locations of beginning and end.
   c. Indicate number of spans and length at center.
d. Show width and location of sidewalks.

e. A vertical curve should be provided. Give curve data and appropriate elevations for proper cap placement. However, even without a vertical curve, deck, bents and abutment elevations are required. Show top of grout pad elevation.

f. If possible, place all bridges on tangents.

g. Is a detour required for construction of the bridge? If so, the Engineer shall provide a traffic control plan. Will the detour require a construction easement?

h. Are utilities required to be attached to the bridge? If so, they should be shown.

i. Can bridge be built in a single phase, or are multiple phases required? Two way traffic must be maintained.

j. Show the ultimate channel profile and section on the drawings.

k. Show the one hundred year flood elevation on the drawings. Also, the normal water elevation.

l. Prestressed box beams are the preferred type of construction. If other types of beams are proposed it should be so indicated and prior approval is required.

m. Bridge railings shall be in accordance with Harris County Engineering Department details.

n. Is additional right-of-way required for the construction of the bridge? If so, this should be so indicated.

o. Use sand-cement grout in keyways. Do not use non-shrink grout.

p. Wingwalls should be designed separate from the bridge, with their own supports. Lengths shall be adequate to contain the appropriate side slopes.

q. The correct piling embedment (minimum of 3") and strand embedment (minimum of 1" - 6") in the cap should be assured.

r. All bridge expansion joints shall extend through sidewalks.

s. Curbing is to be 6 or 8 inches in height to allow for future overlay.
t. Slope paving requirements should be determined. Slope paving shall be a minimum of 4-1/2 inches in thickness, with weepholes and toewalls if required.

u. Show direction of traffic on bridge plans.

v. Indicate all horizontal and vertical control features on the drawings.

w. Pile schedules showing structure, estimated lengths, average calculated pile load and number of piles are required for bent and abutment schedules.

x. Any provisions for future bridge expansion shall be considered in the design.

7. Harris County will contract with a Geotechnical firm for the soils exploratory phase of the project. They can only begin their program in an efficient manner after they have received from the Consultant a preliminary bridge layout in enough detail that indicates existing topography, purported and ultimate channel widths and depths, bridge limits, spans, etc. This will enable the Geotechnical firm to prepare and carry out the soils exploration program and to furnish the Consultant recommended foundation types and support capacity data.
SECTION III

PAVING DESIGN REQUIREMENTS
SECTION III

PAVING DESIGN REQUIREMENTS

1. All pavement design, whether for flexible base, semi-rigid or rigid pavements shall be based on the latest revision of the "AASHTO Guide for Design of Pavement Structures". (Note: The latest guide is copyright 1986.)

2. Pavement design shall not be done on an assumption of soil characteristics, but shall be done only after receipt of a testing laboratory report. Pavement thickness and reinforcement shall be supported by a design analysis. Reinforcement shall be Grade 40 deformed reinforcing bars.

3. For subgrade soil conditions requiring stabilization, the soil shall be stabilized using the material (lime, flyash, etc.) applied at the rate recommended by a soils testing laboratory.

4. All pavement design shall be performed only on the basis of actual laboratory examination of the existing soils encountered at the depth of the proposed pavement subgrade. Flexible base pavement design shall be based on the California Bearing Ratio of the untreated soil. Rigid pavement design shall be based on the modulus of subgrade reaction from plate bearing tests of the untreated soil. The required laboratory test results may be derived from other types of tests actually performed on the soil, provided there exists suitable correlations to the required C.B.R. and plate bearing tests. An acceptable substitution for the plate bearing test would be a correlation between the SDHPT Triaxial test value, and modulus of subgrade reaction, K. It is the ultimate responsibility of the Design Engineer to stipulate the pavement section; the final choice of the pavement design should be his decision, with the County's concurrence.

5. The basis of design shall be:
   a. All major thoroughfares must be designed on the basis of $10 \times 10^9$ equivalent 18 kip single axle loads over a 20 year design period.
   b. Use a serviceability index of 2.5 for all pavement designs.
   c. Use a Level of Reliability, R, of 95%.
   d. A 7 day concrete pavement flexural break strength of a minimum 500 psi by the third-point loading method, using a minimum of 5-1/2 sacks of cement per cubic yard of concrete shall be used in the design of concrete pavements.
e. The following layer coefficients for flexible and semi-rigid pavement materials should be used in the design.

<table>
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<tr>
<th>Material</th>
<th>Coefficient</th>
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<tr>
<td>H.M.H.L. Asphaltic Concrete Surface Material</td>
<td>0.44</td>
</tr>
<tr>
<td>H.M.H.L. Asphalt Base (Black Base)</td>
<td>0.34</td>
</tr>
<tr>
<td>Cement Stabilized Limestone</td>
<td>0.23</td>
</tr>
<tr>
<td>Lime Stabilized Limestone</td>
<td>0.17</td>
</tr>
<tr>
<td>Raw Limestone</td>
<td>0.14</td>
</tr>
<tr>
<td>Cement Stabilized Earth</td>
<td>0.15</td>
</tr>
<tr>
<td>Lime Stabilized Earth</td>
<td>0.11</td>
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f. The Regional Factor used should be between 1.0 and 1.5. In low lying areas prone to flooding, a Regional Factor of 1.5 should be used.

g. The following are the minimum thicknesses to be applied to each asphaltic concrete pavement courses.

- Surface Course: 2 inches
- Base Course: 4 inches
- Sub-base Course (if sub-base is used): 4 inches

The Engineer is required to submit all calculations for pavement design to the County Engineer for review, prior to incorporating the design in final plans and specifications.

6. Where stabilization is recommended, the percentage of the total weight of the material shall be indicated.
SECTION IV

GEOMETRIC DESIGN REQUIREMENTS
SECTION IV

GEOMETRIC DESIGN REQUIREMENTS

1. In general, geometric design shall be based on the "Guidelines for Urban Major Street Design" published by the Institute of Transportation Engineers. Where applicable, geometric design shall also be based on the "Geometric Design Guidelines for Subdivision Streets" as agreed to jointly by the City of Houston and Harris County.

2. The following is offered as further guidelines for intersections, turnouts, transitions and thoroughfares.

   Roadway centerline curves shall not exceed 3 degrees, unless otherwise approved by the County Engineer.

   Super-elevation by reverse curves will not be done.

   Shoulders shall be improved, shall be of a width approved by the County Engineer and shall be of a different surface material and color from the roadway paving, with open ditch drainage.

   All driveways are to be paved to the right-of-way line and are to be of the same surface material as the roadway.

   Traffic lanes are to be 12.0-feet for two lane and four lane divided and 11-feet for four and six lane undivided width and are to be delineated in accordance with the "Texas Manual on Uniform Traffic Control Devices", as shown in the appendix.

   The maximum skew allowed at an intersection is 120°, with a preferable maximum of 100 to 110 degrees.

   The standard 100-foot boulevard shall consist of:
      a. One 31-foot esplanade (back to back of curb)
      b. 12.5 feet for two 25-foot roadways (back to back of curb)
      c. Back of outer curbs to be 9' - 6" from right-of-way line where possible.

   Requirements for intersections, turnouts, transitions and thoroughfares are as follows:
      a. At a "T" intersection with a street that has not been improved to its ultimate width, concrete pavement should be stopped either at the right-of-way line or at the end of the curb return, whichever would require less concrete removal at a future date.
b. When roadway turnouts are placed where an existing cross-street intersects, the turnout should be sized to fit the ultimate pavement width and then transitioned to the existing roadway.

c. The usual transition length for meeting an open ditch street is 50-feet. If the street is shell or asphalt-surfaced, the transition should be a minimum of 8-inches of cement stabilized shell or approved equal, and 1-1/2 inch H.M.A.C. surfacing. If the street is concrete, the transition shall be concrete of a like thickness.

d. When paving only one roadway of a proposed two roadway thoroughfare, all left turn lanes and esplanade crossovers in the one-half of the right-of-way where the roadway is being paved shall be paved to the center line of the street right-of-way.

e. When meeting existing concrete streets at right angles, the existing street should be sawed in a v-shape, extending from the curb return to a point where the centerline of the proposed pavement intersects the quarter point of the existing concrete street to create a crowned intersection. In the event that this construction creates a situation in which the traffic on the existing street will be subject to riding conditions at the posted limit plus 10 mph, whereby the moving vehicle will bottom out when crossing the proposed street intersection, a special design will be allowed to eliminate this dangerous condition.

3. The grade on ditches for roadway sections with open ditches is 0.05 - 0.10 percent per 100 feet. In general, velocities in open ditches should not exceed 2-feet per second.

4. All driveways shall have culverts; paved dips for driveways shall not be allowed.

5. For paved streets with curb and gutter sections, the following guidelines shall apply:

   a. The minimum gradient on the gutter should be a minimum of 0.25 percent per 100 feet.

   b. The maximum drop of grade turnouts from opposite directions to a common inlet shall be 1% per 100 feet.

   c. Grade on driveways, from gutter flowline or edge of pavement, to natural ground at the right-of-way line shall not exceed 13 percent.
d. There shall be a 1 percent fall around intersection
  turnouts for a minimum radius of 25-feet. Grades for a
  larger radius shall be determined on an individual basis.
  In all cases, of course, ties shall be made to existing
  streets.

e. Vertical curves shall be installed when algebraic
  difference in grades exceed one percent. Elevations
  shall be shown at ten foot intervals through vertical
  curves.

f. When a curb and gutter intersects a drainage ditch, the
  elevation of the gutter shall be above the design water
  surface of the ditch.

g. The amount of cross slope over the pavement section
  should be shown on the plans.

h. A minimum gradient of 0.40 percent around the longest
  radius is required on an h-type street intersection.

i. When meeting an existing curbed street, top of curb
  grades should be laid to meet an elevation 3-inches above
  the gutter, except at inlets.

j. Grades should be laid to match the top of curb of an
  existing inlet.

k. Vertical curves should be labeled every 10 feet. 
   Maintain a minimum of 0.03 feet on 10 foot intervals.

l. When curb grades are not laid below natural ground, fill
   lines shall be shown on the drawings.

m. Grades shall be labeled for all top of curbs except at
   railroad crossings. Centerline grades are acceptable for
   open ditch section only.

n. The gradient for tangents to vertical curves at railroad
   crossings shall be a maximum of 3.5 percent, unless
   otherwise approved by the County Engineer.

o. Gutter elevations are required for vertical curves where
   a railroad track is being crossed.

p. Where railroad crossings are not at right angles to the
   pavement slab, vertical curves should be calculated for
   each curb line and should be posted at 10 foot intervals
   in the profile.

q. Inlets should be placed away from the major thoroughfares
   and on the side streets at street intersections.
r. Attempt to keep the proposed inlets away from the esplanade openings and out of major thoroughfare intersections.

s. Inlets should be placed at the end of pavement in order to eliminate drainage from the pavement gutter into an open ditch when the drainage is toward the end of the pavement or from the open ditch to the pavement gutter.

t. Curbs are to be decreased from 6-inches to zero inches in 10 feet when approaching railroad tracks or existing roadway without curb.

u. Valley gutters may be allowed at intersections, however, this is not the preferred practice.

6. Miscellaneous Design Requirements:

a. The type and amount of subgrade treatment should be shown on the plans.

b. If driveways are to be constructed within the project, show locations and typical sections on the plans and post a centerline for the driveway at the property line with elevation for each drive.

c. Paving headers shall be placed at the end of all concrete slabs.

d. All concrete to be removed shall be removed either to an existing joint or a sawed joint.

e. A 45 mph sight distance should be used on all crest vertical curves. If, for some reason, a greater speed limit is allowed, then a greater sight distance shall of course be utilized.

f. Standard Harris County Type III barricades shall be placed at the end of all dead end streets.

g. Horizontal dowels are required when meeting concrete pavement that has no exposed steel.

Dowels should be No. 6 bars plain, 16-inches long, 24-inches center to center, embedded 8-inches and epoxied.

As an alternative to the above, saw cut and remove existing concrete to expose a minimum of 8-inches of longitudinal steel with an equivalent cross sectional area of steel equal to the proposed pavement steel.
h. Dead-end streets designed to be extended in the future shall have 15-inches of reinforcing steel exposed beyond the pavement, coated with asphalt and wrapped with burlap for future pavement tie.

i. Driveways shall be of the same material as the proposed roadway.

Asphalt drives shall be a minimum 2-inch Type "D" HMA asphaltic concrete surface material on a minimum 6-inches of black base over 6-inches of lime or cement stabilized subgrade compacted to 95 percent of standard proctor density at ± 2 percent of optimum moisture.

j. All requirements of the "Texas Manual on Uniform Traffic Control Devices" as published by the Texas Department of Highways and Public Transportation shall be strictly adhered to.

k. Where an expansion joint intersects a driveway, the expansion joint shall be carried to the right-of-way line, to where a transverse expansion joint shall be located on the right-of-way line.
SECTION V
TRAFFIC DESIGN AND RIGHT OF WAY
TRAFFIC DESIGN AND RIGHT OF WAY ACQUISITION REQUIREMENTS

1. Determination of right-of-way acquisition should be based on ultimate geometric design, alignment, fill requirements and drainage requirements. The following items should be considered in determining right-of-way acquisition:
   a. Left turn storage lanes
   b. Dual left turn lanes
   c. Right turn lanes
   d. Transitions
   e. Shoulders
   f. Sidewalks (limited to replacement of existing walks only unless specifically instructed otherwise by the County Engineer).
   g. Drainage facilities/fill requirements
   h. Future signalization
   i. Angle of intersections with all streets
   j. Alignment of major thoroughfares
   k. Schools, hospitals, shopping centers, or other traffic generators.

2. Traffic Design Requirements are as follows:
   a. Minimum turning radii based on operating approach speed are:
      1. Less than 35 mph, minimum 30 feet;
      2. Greater than 35 mph but less than 45 mph, 35 feet;
      3. Greater than or equal to 45 mph, 35 feet with right turn lanes, otherwise 45 feet.

3. Recommended lane width (see geometric design requirements):
   a. Desirable is 12-feet
   b. Minimum of 11-feet
4. Where applicable, the "Roadway Design Standards", prepared by the City of Houston Traffic and Transportation Department, shall be used to determine such items as:
   a. Left turn storage capacity,
   b. Spacing of esplanade openings,
   c. Median openings,
   d. Bullet type esplanade dimensions,
   e. Traffic button layouts, etc.

5. Transitions should be based on:
   \[ L = \frac{W S^2}{60} \] for urban residential and other streets with speeds 40 mph or less
   \[ L = S \times W \] for major thoroughfares where speeds are 45 mph or greater

   Where \( L \) = length, \( S \) = design speed, \( W \) = offset on one side, ..n feet of the traveled lanes or may be expressed as the difference in overall width of the pavement.

6. Minimum returns should be based on:
   P.I. to P.I. = 100 feet, using a radius of 500 feet

7. Should the end of the transitions be closer than ± 500 feet to the next left turn lane transition, then a median, continuous left turn lanes, or esplanade should be used to avoid a weaving effect.

8. Channelized islands should be offset 2-feet from edge of pavement.

9. Use reflectorized pavement markings and/or striping in lieu of mountable curbs to channelize left turn lanes.

10. Horizontal curves should not exceed 3 degrees and super-elevation should not be used except with prior approval of the County Engineer. Where super-elevation is used, it should be based on the following equation:

   \[ \frac{V^2}{e} = 15R - f \]

   Where:
   - \( e \) = rate of roadway super-elevation in feet per feet
   - \( f \) = side friction factor
   - \( V \) = vehicle speed in mph
   - \( R \) = radius of curve in feet
11. Vertical curves should be based on the following equation:

\[ L = K A \]

Where:

\( L \) = length of the vertical curve in feet (see SDHPT Operations and Procedures Manual)

\( K \) = a constant used for design

\( A \) = the algebraic difference of grades in percent

12. Design of guard rails should be in accordance with the "Highway Design Operations and Procedures Manual 2-76", as published by the State Department of Highways and Public Transportation.

13. Traffic control in construction zones shall be in complete compliance with the "Texas Manual on Uniform Traffic Control Devices" (MUTCD), as published by the State Department of Highways and Public Transportation and should include the following:

a. Temporary striping and removal as soon as practical (a temporary striping plan as well as a permanent striping plan shall be included in the drawing set).

b. Placement, relocation and maintenance of signs, signals, lighting devices, markings, barricades channelizing and hand signal devices.

c. Reflectorized pavement markers and paint striping should be in accordance with the Harris County Engineering Department Standards and Specifications.

d. Pavement edge lines, stop bars, lane lines, transverse markings, curb markings, center lines, no passing zones, transitions, channelizing, crosswalks, railroad crossing markings, symbol markings and etc. should be shown on the plans and shall be in accordance with the MUTCD.

e. Left turn lanes should be considered at all major intersections and traffic generators (schools, shopping centers, etc.).

14. Location and design of traffic signals or relocation and/or modification of signals shall only be done with prior written approval of the County Engineer. Design guidelines for traffic signals will be furnished by the Harris County Engineering Department.
SECTION VI

DRAINAGE AND STORM SEWER DESIGN REQUIREMENTS
SECTION VI
DRAINAGE AND STORM SEWER DESIGN REQUIREMENTS

GENERAL

1. Storm Sewer Systems

1.1 All storm sewers and appurtenant construction shall conform to the Harris County Engineering Department Construction Specifications.

2. Pavement Elevations

2.1 High point of the top of the curb shall be at not more than 3-inches below natural ground.

3. Design Requirements

3.1 The City of Houston "Rainfall Runoff Curves, Three Year Frequency, Drawing No.: S-506", shall be used as the criteria for determining runoff and discharge.

3.2 Gutter grades should be a minimum of 0.25 percent per 100 feet.

3.3 Runoff originating outside the designated limits shall be determined by a complete study of the area using Harris County Flood Control District curves or City of Houston curves, for a three year frequency.

3.4 A maximum 150-foot wide strip each side of and adjacent to the proposed road right-of-way, except for developed areas drained elsewhere, shall be considered as commercially developed surface (curve No. 1), contributing runoff to the roadway. The contributing runoff from all areas outside the two 150-foot wide strips shall be computed in accordance with existing characteristics as outlined by paragraph 3.3. Where area is to be considered outside the 150-foot wide strip, a written explanation shall be submitted to the Engineering Department as to why it is included in the drainage area.

3.5 Storm sewers, inlets and roadside ditches shall be designed to handle a three year frequency rainfall. The velocity in the storm sewer shall be a preferred 3 fps. The hydrologic methodology used shall be in accordance with the "Hydrology Manual for Harris County, Texas", prepared by the Harris County Flood Control District.
3.6 All outfall ditches shall be designed to handle a 25 year frequency rainfall and a backwater curve shall be plotted in red on a set of bluelines of all outfall ditches and storm sewers to determine flood hazards. A separate letter report shall be sent to the County Engineer, discussing these findings.

3.7 Location of outfall ditches shall, where practical, coincide with future ditch locations specified by the Harris County Flood Control District. The outfalls into all Harris County Flood Control ditches and other drainage waterways shall provide protection against soil erosion and energy dissipators as required by the "Criteria Manual for the Design of Flood Control and Drainage Facilities in Harris County, Texas", as prepared by the Harris County Flood Control District.

3.8 Where open ditch drainage is proposed, the minimum depth of roadside ditches shall be 18-inches and the maximum depth shall not be more than 4-feet, unless prior approval is obtained. Low flow storm sewers, below the ditches, shall not be used.

3.9 The minimum preferred unlined or unimproved roadside ditch section should have a side slope no steeper than three (3) horizontal to one (1) vertical configuration. The steepest slope shall not exceed two (2) horizontal to one (1) vertical.

3.10 In locations where ditches are four feet or more in depth, a metal guard rail is required along the top of the front slope. This requirement may be waived by the County Engineer provided an adequate distance exists between the edge of the shoulder and the top of the front slope of the ditch.

3.11 On four-lane roadways, the spacing and inlet size for storm sewer design shall be such that not more than one lane width of water shall pond in the low gutter of curbed sections.

3.12 The minimum grade or slope of roadside ditches shall be 0.10 percent unless approval is obtained from the County Engineer. The average velocity within the ditch should not exceed 2-feet per second.

3.13 The Consulting Engineer shall provide a contour and drainage area map.

3.14 The Consulting Engineer shall submit drainage calculations, based upon curves, to support line sizes and slopes. The "n" coefficient in Mannings Formula shall be 0.013 for concrete pipe and 0.024 for corrugated pipe.
3.15 Calculations of the hydraulic gradient shall be furnished by the Design Engineer and shown on the plans. The hydraulic gradient is to be based upon the water surface in the outfall ditch or channel for a 25 year storm and discharges developed for Harris County Flood Control District curves through the proposed system maintaining hydraulic gradient below gutter elevation in all instances. For approved open ditch sections the hydraulic gradient shall be 0.5 feet below the edge of pavement or natural ground elevation, whichever is greater. In the calculation of the hydraulic gradient line for a proposed system the 25 year storm is to be used at the outfall ditch or channel, while the design discharge (3 year rain) is to be routed through the system itself.

3.16 The minimum size pipe for storm sewers shall be 24-inches inside diameter pipe or equivalent cross-sectional area and shall be designed to have a minimum velocity of three feet per second when flowing full. The minimum size storm sewer inlet leads shall be 24-inches inside diameter or equivalent cross-sectional area.

3.17 The "n" coefficient in Mannings Formula for open ditch calculations shall be based on the surface treatment of the completed channel section, with 0.035 as the minimum coefficient for unlined ditches.

3.18 A graphic plot and calculations of the hydraulic gradient employing culvert design parameters shall be shown for each drainage section and shall be 0.50 feet below the edge of pavement or natural ground elevation, whichever is lower.

3.19 The minimum size culvert shall have a cross-sectional area equal to or greater than a 24-inch inside diameter pipe. Pipe culverts shall conform to ASTM Specifications C-76, Class III, for reinforced concrete pipe. All proposed and reasonable expected future culverts shall be included in the hydraulic profile.

3.20 Erosion control methods acceptable to the County Engineer shall be utilized in ditch designs where the velocities of flow are calculated to be greater than 5 fps, or where soil conditions dictate their need.

3.21 Ring grates are required at the end of all storm sewer leads to open ditches.

4. Materials, Alignments and Spacing

4.1 Materials:

All storm sewers shall be constructed with reinforced concrete pipe or boxes, either precast or cast in place type.
The use of corrugated galvanized metal pipe may be used only at the storm sewer outfall into lined or unlined channels.

4.2 Alignments:

All cast in place concrete storm sewers shall follow the alignment of the right-of-way easement.

All storm sewer inlet leads shall be designated in a straight line alignment.

All sewers shall be located in public street right-of-way or in easements adjoining or parallel to street right-of-way.

In all easements restricted to storm sewers, the pipe shall be entered within the limits of the easement.

4.3 Spacing:

Manholes are required at all pipe size or conduit cross-sectional changes.

Manholes are required at all pipe sewer intersections or P.I.'s.

Manholes are required at all pipe sewer grade changes (precast pipe only).

Manholes are required at all street intersections.

Manholes are required at a maximum of six-hundred feet (600') measured along the center line of the pipe sewer.

Manholes are required at all inlet lead intersections with the pipe sewer where precast concrete pipe sewers are designed. Manholes are not required where inlet leads intersect a monolithic concrete storm sewer; however, manholes may be required as necessary to provide access for adequate maintenance of lead lines.

Inlets must be spaced to serve the calculated runoff. Curb inlets shall be spaced so that the maximum travel distance of water in the gutter shall not exceed 300 feet one way. Curb inlets shall be located on intersecting side streets to major thoroughfares on all original designs. Special conditions warranting other locations of inlets shall be determined on a case by case basis by the County Engineer. Type "BB" inlet or equal is to be used as a curb inlet on curbed streets. The capacity of a type "BB" inlet is 5 c.f.s. All inlets are to be constructed of brick masonry, cast in place concrete or
may be precast as approved by the County Engineer. Grate-top inlets are not permitted to be used in unlined open ditch areas. The County Engineer shall stipulate the type(s) of inlets that are preferred in these ditches.
SECTION VII
SANITARY SEWER DESIGN REQUIREMENTS
SECTION VII
SANITARY SEWER DESIGN REQUIREMENTS

1. Sanitary sewers shall be designed in accordance with the City of Houston, Department of Public Works, "General Design Requirements for Sanitary Sewers, Storm Sewers, Waterlines and Paving."
SECTION VIII

WATERLINE DESIGN REQUIREMENTS
SECTION VIII
WATERLINE DESIGN REQUIREMENTS

1. Water lines shall be designed in accordance with the City of Houston, Department of Public Works, "General Design Requirements for Sanitary Sewers, Storm Sewers, Waterlines and Paving".
SECTION IX

UTILITY INFORMATION REQUIREMENTS
 SECTION IX

UTILITY INFORMATION REQUIREMENTS

The following provisions outline the responsibility of the Consulting Engineer with respect to utility information to be included in the design phase of engineering contracts for bond projects with the Harris County Engineering Department.

A. It shall be the responsibility of the Consulting Engineer to include all existing utilities in the plan and profile drawings of both the preliminary and final design phases of the project. Such inclusion is considered to be a prerequisite to approval of the drawings by the Harris County Engineer.

Utilities to be included in plan and profile drawings are as follows:

- Pipelines - road crossings and lines parallel to right-of-way.
- Power Lines - aerial (pole lines) and buried.
- Telephone Lines - aerial (pole lines) and buried.
- Water Lines - municipalities, water districts and privately owned.
- Sanitary Sewer Lines - municipalities, water districts and privately owned.
- Gas Lines - mains and service lines.
- Miscellaneous - television cables, microwave facilities, valve and compressor installations for pipelines, sanitary sewer lift stations, and any other utilities on or adjacent to the project insofar as they are pertinent.

B. The responsibility for showing all utilities on drawings includes those located on any off-site drainage facilities or side roads which are designated as part of the project.

C. A detailed listing of all utilities and specific locations of known conflicts shall be required to accompany presentation of both preliminary and final design drawings.

D. A sign off area (example attached) which verifies utilities to be shown on drawings shall be included on the cover sheet of the final drawings and the signatures of representatives of the utility companies involved will be required prior to approval of the drawings.
E. In addition to the areas of responsibility listed above, the consulting Engineer will be expected to:

1. Attend meeting with utility companies subsequent to the preliminary submittal for the purpose of discussing either relocation of utilities or design changes to eliminate conflicts.

2. Make every possible effort to include in the plan and profile drawings those utilities installed on the job site between the time of initiation and completion of the design drawings.

F. Provide a note on all plan and profile sheets with utilities, warning the Contractor that when work is done in the vicinity of any pipelines he shall contact the respective company (names and phone numbers).

G. Provide a listing of all utility owners and pole numbers for each utility pole in the R.O.W. limits throughout the job. This listing is to be provided in the Preliminary Engineering Report.
EXAMPLE:

PRIVATE UTILITIES SHOWN:

ENTEX
SOUTHWESTERN BELL
TELEPHONE CO.

HOUSTON LIGHTING
AND POWER CO.

W.O.L.D. NO.

PIPELINE CO.
SECTION X

CONSTRUCTION DRAWING REQUIREMENTS
SECTION X

CONSTRUCTION DRAWING REQUIREMENTS

Following are requirements for the preparation of construction drawings:

1. The title sheet is to show road name and county road number, limits of proposed construction, fund out of which the construction is to be paid, date, names and job titles of the County Judge, each Commissioner and County Engineer with approval locations for the County Flood Control Engineer. See also the requirements of the utility section of these guidelines. The title sheet is also to include an index of drawings. The required format of the title sheet is attached hereto.

2. The plans are to include plan-profile sheets and cross-section sheets. Cross-sections are to be drawn at maximum 100-foot stations and other intermediate locations as required to adequately show specific construction of significant changes in elevation. The cross-sections shall be drawn to a preferred minimum scale of 1-inch equals 5-feet. Dirt work shall be computed by the method of average end areas from the cross-section. The volume of cut and fill shall be shown between each station and totalled at the bottom of each sheet.

3. The seal, date and original signature of an Engineer is required on each sheet. The Engineer may use a stamped, stick-on or embossed imprint of his/her seal. However, the seal must reproduce on prints.

4. A bench mark elevation and description is required on each sheet (should include latest year of adjustment i.e., 78, 73, 64, etc.). See number 26, below.

5. Label each plan sheet as to street widths, pavement widths and thickness, type of roadway materials, curbs, intersection radii, curve data, stationing, existing utilities-type, location, etc.

6. Stationing must run from left to right.

7. A North arrow is required on all plan sheets.

8. If a roadway exists where plans are being prepared to improve or construct new pavement, this roadway should be labeled as to its existing width, type of surfacing and base thickness, if available.

9. Do not place match lines in intersections.

10. All utility lines, regardless of size, shall be shown in the plan and profile.
11. Show flowline elevations and direction of flow for all existing and proposed ditches.

12. Show natural ground profiles at each right-of-way or easement line. Centerline profiles will be satisfactory for rights-of-way or easements except where there is a difference of 0.50 feet or more from one right-of-way easement line to other, in which case dual profiles will be required.

13. Make a recommendation for resolving all known conflicts of proposed utilities with existing utilities.

14. Plans shall be standard 24-inch x 36-inch overall dimensions.

15. Details of special structures not covered by approved standard drawings, such as stream and gully crossings, etc., should be drawn with horizontal and vertical scales equal to each other.

16. All street and/or road alignments shall be shown on plans.

17. Plans shall be drawn to accurate scale, showing proposed pavement, typical cross-sections and details, lines and grades, and all topography within the right-of-way. At intersections, the cross street shall be shown at sufficient distance in each direction along the side street for designing adequate street crossing.

18. Curb return elevations for turnouts shall be shown in the plan and profile.

19. Grades should be labeled for the outside top of curb except at railroad crossings. Centerline grades are acceptable only for paving without curbs and gutters.

20. Gutter elevations are required for vertical curves where a railroad track is being crossed.

21. The surface elevation at the property line of all existing driveways should be shown in profile.

22. Station all esplanade noses, both existing and proposed.

23. The design of both roadways is required on all pavement sections with an esplanade.

24. Station all P.C.'s, P.T.'s, radius returns and grade change P.I.'s in the plan view. Station all radius returns and grade change P.I.'s in the profile, with their respective elevations.

25. The standard scales permitted for plan and profiles of paving plans are as follows:

\[
1 = 2' \text{ vertical} \\
1 = 20' \text{ horizontal}
\]
These scales are the minimum and larger scales may be used to show details of construction.

26. FEMA has established bench marks on County bridges, culverts, etc. Where these bench marks are to be relocated during construction, it will be so noted on the construction drawings.

27. The following is a checklist for drawings of prestressed multi-beam box girder bridges:

<table>
<thead>
<tr>
<th>NAME OF BRIDGE/STREET</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROAD LOG NUMBER OF BRIDGE/STREET</td>
</tr>
<tr>
<td>NAME OF BAYOU, STREAM, DITCH OR H.C.F.C. DITCH NUMBER</td>
</tr>
<tr>
<td>DATE</td>
</tr>
<tr>
<td>CHECKED BY</td>
</tr>
<tr>
<td>TITLE SHEET</td>
</tr>
<tr>
<td>a. Date</td>
</tr>
<tr>
<td>b. Index</td>
</tr>
<tr>
<td>c. Location Map</td>
</tr>
<tr>
<td>d. Name of street and road log number</td>
</tr>
<tr>
<td>e. Number or name of ditch or creek</td>
</tr>
<tr>
<td>f. Precinct</td>
</tr>
<tr>
<td>g. Fund</td>
</tr>
<tr>
<td>h. County Judge, Commissioners, Engineer and Auditors Name</td>
</tr>
<tr>
<td>i. Approved signatures, where required</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BRIDGE LAYOUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Length of bridge, length of approach slab, width of roadway, width of curb and sidewalk</td>
</tr>
<tr>
<td>b. Station at C.L. of each bent</td>
</tr>
<tr>
<td>c. Elevation top of cap and bottom of cap at C.L. on bent detail sheet</td>
</tr>
<tr>
<td>d. Elevation top of decking at C.L.</td>
</tr>
<tr>
<td>e. Rail post spacing</td>
</tr>
</tbody>
</table>
f. Traffic lane marker or paint spacing

g. Location and elevation of benchmark used (USGS) of City of Houston

h. Positions, sizes and length of piling (or drilled shaft and underreamed footing). Pile schedules shall be on the abutment and bent detail sheets.

i. Soil profile to be attached at the end of the specifications as an appendix.

j. Proposed slope and width of channel and the length of proposed improvement of channel. Show all necessary slope protection.

k. Design criteria (showing design load, either H20 or HS20)

l. Scale for plan and profile - 1" = 10' horizontal and vertical.

m. North arrow

n. Transition from new bridge roadway to existing width of roadway

o. Construction Notes:

1. Contractor to contact utility coordinating committee 48 hours prior to commencing any work. Give telephone numbers for contract.

2. Payment for removing structure (if any)

3. Payment for backfill

4. Payment for approach slab sub-base

5. Payment for materials required to tie approach slab to existing road and transitions to existing road.

6. 3/4" chamfer on all exposed corners.

7. Notes are sometimes needed to indicate limits for some items.

ABUTMENT DETAIL

a. Plan and elevation view (showing spacing of beams) and bearing pad outlines.

b. Positions of piling (or drilled shaft), in plan and elevation views
c. Sections at C.L. showing reinforcing steel, approach slab and joint detail. Two or more sections may be required for retaining walls.

d. Section at sidewalk showing reinforcing steel

e. Sections at wingwall showing reinforcing steel (a minimum of two sections, one cross-section and one longitudinal section is required).

f. All reinforcing steel shall be identified as to size and spacing

g. Scale for each detail. Do not use the term "not to scale".

**INTERIOR BENT DETAIL**

a. Plan and elevation view (showing spacing of beams) and bearing pad outlines.

b. Positions of piling (or drilled shaft) in plan and elevation view.

c. Section at C.L. showing reinforcing steel and connection of box girders (fixed or expansion)

d. All reinforcing steel shall be identified as to size and spacing

e. Scale for each detail

f. Pile schedule

g. Beam seat details for abutment and bents

h. General Notes - Class of Concrete and 28 day strength etc.

**BENT GIRDER DETAIL**

a. Box girders layout (plan)

b. Deck Section (elevation) showing C.L. of roadway, girders, decking and its reinforcing steel, curb and sidewalk, slope of roadway, drain holes, etc.

c. Typical section of box girder showing spacing and size of prestress strand, prestress force, stirrups, dowels, bond breakage, etc. Deflection tables shall be included on the plans to ensure that proper stressing is employed in the box girders.

d. All reinforcing steel shall be identified as to size and spacing
a. Reinforcing steel dimension detail and bar bending details, where necessary

f. Connection between box girder (grout key, shear plate)

g. Scale for each detail

h. Cross-section of bridge showing deck slope, number of box girders, sidewalk reinforcing detail and guard rails connection.

i. Bearing pad details

PILING OR DRILLED SHAFT AND UNDERREAMED FOOTING DETAIL

a. Reinforcing detail (for piling or drilled shaft), including cutback and buildup details

b. Piling handling detail

c. Underreamed footing detail showing base diameter, angle of bell, etc.

d. General construction notes

RAILING DETAIL

a. Plan and elevation view showing spacing of rail posts

b. Any necessary detail based on type and material of railing; this should include detail of connection of posts and bridge, connection of posts and rail, etc.

TRAFFIC BUTTON DETAIL

a. Plan and elevation showing dimensions using standard Harris County detail

b. Specify type and color of button surface (e.g. white glazed ceramic surface).

BRIDGE PLAQUE

a. Check all names to be sure they are current and up to date.

b. Note for Contractor to submit a rubbing or plaque for approval

c. Location and method of mounting

d. Use Harris County standard plaque drawing
MISCELLANEOUS DETAILS

a. Armour joints
b. Drains
c. Slope paving
d. Approach slab

29. NOTE: No changes shall be made to any Harris County Drawings, at the direction of any other agency or department without the direction and concurrence of the HARRIS COUNTY ENGINEERING DEPARTMENT.
The following graphic standards for plan and profile shall apply to all drawings of 1" = 20' scale.

- Plan View
- Property Line
- Ditches, Left and Right (Freemond)
- Center Line of Right-of-Way
- Transit Line
- Fence Line
- Edge Concrete
- Curb Line
- Edge of Asphalit (Freemond)
- Edge of Shell or Gravel
- Dimension Line
- Theoretical Property Line
- H.L. & P. Co. Conduit
- Gas Line
- Western Union Conduit
- S.W.B.T. Conduit
- Railroad
- Lot Lines
- Watch Line
- Cable TV
Profile View
North or East Property Line
South or West Property Line
North or East Ditch or Curb
South or West Ditch or Curb
Center Line of Right-of-Way

H.L. & P. Co. Conduit
Gas Line
Western Union
S.W.B.T. Conduit
Water Main
Sanitary Sewer Line
Storm Sewer Line

NOTE: Pipe less than four inches (4") in diameter need not be shown in profile.
H.L. & P. Co. Manhole

S.W.B.T. Manhole

Sanitary Sewer Manhole and Cleanout

Storm Sewer Manhole
Plan View

Water Line

Water Valve (Gate)

Water Valve (Butterfly)

Tapping Sleeve and Valve

Fire Hydrant

Reducers

Round Connections

Profile View

Water Line

24" (and Smaller) Water Main

30" (and Larger) Water Main

W.V.

B.F.W.V.

T.S. & V.

F.H.

W.V.

12"

8"

ALL SIZES
Plan View

Face of Curb
Edge of Pavement
Concrete Walk
Concrete Header
Top of Curb or Gutter Elevation

Profile View

Top of Curb or Center Line of Open Ditch Paving

T.C. = 76.85  G. = 76.35
T.C. @ +0.03%  T.C. @ -0.03%
The following outline describes the minimum requirements for mandatory 75 and 90 percent plan review submittals.

Intermittent reviews and conferences will be requested when necessary. The Engineer should check the construction drawings against this outline for inclusion of these items prior to submitting drawings for respective reviews.

Minimum Requirements for 75% Plan Review Submittal:

A. Title Sheet.
B. Complete Drainage Area Map with contours.
C. Typical Sections.
D. Plan/Profile Sheets.
   1. Storm Sewer size, alignment and profile grade, including horizontal and vertical ties.
   2. Utility lines, size, horizontal and vertical alignment and description. (Utility conflicts must be identified).
   3. Plan/Profile of proposed and existing roadside ditches, outfalls.
   4. Existing pavement widening areas.
   5. Proposed pavement alignment and profile grade.
E. Bridge drawings, preferably with superstructure 100 percent complete and preliminary layouts of the substructure.
F. Intersection schematics.
G. Structural details.
H. Limits and details of retaining walls.
I. Detour plans.
J. Cross-sections (including underground utilities such as storm sewers, water mains, etc.).
K. Soil boring and bridge foundation recommendations.
L. Define additional right-of-way requirements (including all easements, rights of entries, etc.).
M. Preliminary construction quantity estimate and construction cost estimate.
N. Construction sequencing.

O. Traffic signal design should be submitted where applicable.

Minimum Requirements for 90% Plan Review Submittal: (All items in the 75% Plan Review, plus:

A. Design plans and calculations/construction specifications and contracts and bid items.

B. Title Sheet complete.

C. Typical sections complete.

D. Intersection, cross street geometrics and grades complete.

E. Drainage details (including junction boxes, modified inlets etc.) retaining wall and bridges complete.

F. Traffic detour plans complete.

G. Signing, lighting, pavement markings should be included in design documents.

H. Traffic signal design complete.

I. Supplemental specifications, special provisions, special notices to contractor.

J. Construction sequencing, if required.

K. Quantity take-off index to Contractor's pay items approximately 90% complete.
SECTION XI

SPECIFICATION REQUIREMENTS
SECTION XI
SPECIFICATION REQUIREMENTS

1. The Engineer is required to furnish the County Engineer as many preliminary specifications, for review, as the County Engineer deems necessary to produce a final acceptable approved set.

2. There are certain specifications pre-printed and available at the office of the County Engineer to produce a final acceptable approved set. These are listed below.

3. Each and every bid item on the bid proposal form shall have a controlling specification in the "Project Manual".

4. The following is the "Project Manual" format and sequence:
   a. Specifications and Bid (Front Cover)
   b. General Notice to Contractors
   c. Letter of Evidence
   d. Bidder's Certification
   e. Bid to Commissioners' Court
   f. Contract with Harris County (Two Copies)
   g. Notice to Contractors
   h. Bid Sheet
   i. Special Notice to Contractors
   j. General Bond Information
   k. Prevailing Wage Rates
   l. Financial Statement (Four Sheets)
   m. Harris County General Requirements and Covenants
   n. Special Provisions
   o. Special Specifications
   p. Geotechnical Report (If Available)

The Harris County Engineering Department construction specifications will be in a separate volume.

5. The following is a listing, by item, of the Harris County Engineering Department specifications that can be furnished to the Consulting Engineer.

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<td>Lime-Fly Ash or Fly Ash Stabilized Subgrade</td>
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<td>231</td>
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<td>250</td>
<td>Hot Mix Asphaltic Concrete Base Course (Black Base)</td>
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<td>251</td>
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APPENDIX

In addition to the guidelines outlined prior to this appendix, the following manuals, design requirements and guidelines are offered herein as references. The design requirements of these references, where applicable, shall be used by Engineers having contracts with Harris County.

A. "General Design Requirements for Sanitary Sewers, Storm Sewers, Waterlines and Paving", prepared by the City of Houston Department of Public Works.

B. "Roadway Design Standards", prepared by the City of Houston Traffic and Transportation Department.

C. "Geometric Design Guidelines for Subdivision Streets, Harris County and City of Houston".


E. "Texas Manual on Uniform Traffic Control Devices (MUTCD)", prepared by the State Department of Highways and Public Transportation.


H. "Hydrology Manual for Harris County, Texas", prepared by the Harris County Flood Control District.

I. "Criteria Manual for the Design of Flood Control and Drainage Facilities", prepared by the Harris County Flood Control District.
Mr. James R. Adams, County Engineer  
Harris County Engineering Department  
700 Harris County Administration Building  
1001 Preston  
Houston, Texas 77002  

Re: Time Card Documentation Requirements of Sub-Contractors to your Engineering Consultants

Dear Mr. Adams:

The County Auditor's Office requires that all invoices from your Engineering consultants for "Compensation Due for Additional Services and Charges" submitted by their sub-contractors be accompanied by properly documented time sheets of the individuals who performed the work. An example would be charges for field surveys which are billed as salary cost times a multiplier. The time sheets should be signed by the individual doing the work and by his or her supervisor. The signature of the consulting engineer who authorized the sub-contract work is not required on the time sheets as long as he or she signs the invoice.

The County Auditor's Office also requires this same time card documentation procedure of your materials engineering and testing services and surveying contractors who are billing the County on an hourly basis for their engineering and technician's services, both for field and office personnel.

Time sheets are not required of your engineering consultants who perform their professional service on a percentage fee of the total construction cost of the project.

A similar procedure of time card documentation was implemented with the Flood Control District on November 1, 1987.

We recommend that you initiate this procedure on all new contracts with your professional consultants beginning August 1, 1989.

Yours very truly,

J. F. Flack  
County Auditor
BRIDGE LAYOUT CHECK LIST

PLAN
1. Scale: 1" = 10'
2. Show existing topography and contours.
3. Show any proposed channel change or future channel with flow direction.
5. On proposed bridge show:
   a. Beginning and end stations
   b. Curb or sidewalk width
   c. Roadway width
   d. Overall width
   e. Armor joint locations
   f. Skew angle if skewed
6. Show existing or proposed approach pavement and approach slabs.
7. Show any proposed riprap or slope pavement.
8. Guard beam layout.
9. Soil boring locations.
10. Show any horizontal curve data.

PROFILE
1. Scale: 1" = 10'
2. If bridge is normal, show true elevation.
3. If skewed, show section on G_L.
4. Existing ground line at G_L bridge.
5. Beginning and end of bridge stations with proposed elevations.
6. Number bents, show fixed or expansion conditions.
7. Proposed profile grade with vertical curve data.
8. Span lengths and descriptions.
9. Overall bridge length.
10. Pile type, size, number and lengths.
11. Or drilled shaft diameter and lengths.
12. Rail type and post spacing.
13. Soil boring logs.
14. High and normal water elevations.
15. Horizontal clearances if over roadway or railroad.
16. Minimum vertical clearances if over roadway or railroad.
17. Guard beam post spacing.
ROADWAY DESIGN STANDARDS
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<td>CUL de SAC FOR NON-RESIDENTIAL STREETS</td>
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The geometric design standards, cross sections and right-of-way widths illustrated in this book are established to provide maximum use of right-of-way for the safe and efficient movement of traffic. The design standards are grouped into three classifications:

- Major Streets or Thoroughfares
- Local Streets for Residential Use
- Local Streets for Non-Residential Use

### MAJOR STREETS OR THOROUGHFARES

60 ft. Right-of-Way
A 44 ft. wide roadway with curbs is recommended in an existing 60 ft. right-of-way where the acquisition of additional right-of-way is not economically feasible. See figure A, Page 3.

80 ft. Right-of-Way
Dual 23 ft. wide roadway with curb separated by a 14 ft. esplanade. See figure B, Page 3.

90 ft. Right-of-Way
Dual 23 ft. wide roadway with curb separated by a 24 ft. esplanade. See figure C, Page 3.

100 ft. Right-of-Way
Minimum right-of-way width required for a designated major thoroughfare. First stage roadway development is dual 23 ft. wide roadway with curbs separated by a 34 ft. esplanade. Second stage roadway development is dual 33 ft. roadway with the additional width taken from the esplanade. See figures D1 and D2, Page 3.

120 ft. Right-of-Way
First stage roadway development is dual 23 ft. roadway with curbs separated by a 54 ft. esplanade. Second and third stages roadway developments, dual 33 ft. or 43 ft. roadways with additional widths taken from the esplanade. See figures E1, E2 and E3, Page 3.

150 ft. Right-of-Way
First stage roadway development is dual 23 ft. wide roadway with curbs separated by a 66 ft. esplanade. Additional lanes, taken from the esplanade, are added as necessary to accommodate increased traffic flow at later stages. See figure F, Page 3.
LOCAL STREETS (Residential)

50 ft. Right-of-Way — 27 fl. wide roadway with curb is recommended. Lot width at right-of-way cannot be less than 40 ft. See Figure A, Page 4.

55 ft. Right-of-Way — 27 fl. roadway with curbs. Minimum 35 ft. wide roadway with curbs when adjacent property is single family residential with lot widths at the right-of-way line less than 40 ft. wide. See figure 8, Page 4.

60 ft. Right-of-Way — 27 fl. wide roadway with curbs. Minimum 35 ft. wide roadway with curb when lot widths at the right-of-way line is less than 40 ft. See figure C, Page 4.

LOCAL STREETS (Non-Residential)

50 ft. and 55 ft. Right-of-Way — 35 ft. roadway widths with curbs where the adjacent property development is apartments, businesses, schools or parks and acquisition of additional right-of-way is not economically feasible. See figure D and E, Page 4.

60 ft. Right-of-Way — 40 ft. wide roadway with curbs where the adjacent property development is apartments, businesses, schools or parks. See figure F, Page 4.
(Figure A) 50' R-O-W - Single - Family Use

(Figure D) 50' R-O-W - Apartment, Business, School or Park Use

(Figure B) 55' R-O-W - Single - Family Use
*Minimum 35' Wide Roadway when Adjacent Property of R-O-W is Less Than 40' Wide

(Figure D) 50' R-O-W - Apartment, Business, School or Park Use

(Figure F) 60' R-O-W - Apartment, Business, School or Park Use
*Minimum 35' Wide Roadway when Adjacent Property of R-O-W is Less Than 40' Wide
R3=25 ft. minimum for right angle
30 ft. minimum for acute angle

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<tr>
<th>W</th>
<th>R1</th>
<th>R2</th>
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<td>NONE</td>
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<tr>
<td>&gt;=8'</td>
<td>90</td>
<td>W/5</td>
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<td>&gt;=44'</td>
<td>15'</td>
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See pages 6 and 9 for details.
CROSS STREET
TOTAL PAVEMENT WIDTH
CROSS SECTION
27" ..................................... 45' OR 40' (DEPENDING ON TYPE OF OPENING)
40" ..................................... 45'
44" ..................................... 50'
52" ..................................... 60'
60" ..................................... 70'
80" ..................................... 90'
* INCLUDING ESPLANADE, IF ANY

ESPLANADE WIDTH - BOX TYPE W> 44'

R1 = 90' BULLET NOSE
15' BOX TYPE OPENING
R2 = W-.5 ROUNDED ON 1/2 TO NEAREST 1/2
ONE-HALF (1/2) INCH

6
ABUTTING LAND USE | LENGTH OF ESPLANADE BETWEEN INTERSECTIONS | NUMBER OF ESPLANADE OPENINGS BETWEEN INTERSECTIONS | SPACE OF ESPLANADE OPENINGS DIMENSION "A" |
<table>
<thead>
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<td>000.0FT. TO 520.0FT.</td>
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<tr>
<td>BUSINESS</td>
<td>000FT. TO 520FT.</td>
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<td>000.0FT. TO 520.0FT.</td>
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<td>237.5FT. TO 380.5FT.</td>
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<tr>
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<td>320FT. TO 805FT.</td>
<td>1</td>
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<td>238.5FT. TO 332.0FT.</td>
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<td>2 OR MORE.</td>
<td>332.0FT. TO 805.0FT.</td>
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<tr>
<td>BUSINESS</td>
<td>OVER 1085.0FT.</td>
<td>3 OR MORE.</td>
<td>237.5FT. TO 380.0FT.</td>
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NOTES:
- DIMENSION "C" = 45 FT.
- DIMENSION "D" = 100 FT./150 FT.
- DIMENSION "E" = 100 FT. MINIMUM
- DIMENSION "F" = 100 FT.
- DIMENSION "G" = 100 FT.
- DIMENSION "H" = 50 FT. MINIMUM

MID BLOCK LEFT TURN LANE - WHERE THESE DESIGN STANDARDS PERMIT AND WHERE REQUIRED FOR TRAFFIC SAFETY, THE CONSTRUCTION MID BLOCK LEFT TURN LANES MAY BE AUTHORIZED, PROVIDED THE COST IS PAID BY PROPERTY OWNER REQUESTING CONSTRUCTION.

* THE IDEAL SPACE IS BETWEEN 320 FT. AND 350 FT.
LEFT TURN LANE DESIGN OR PRIVATE DRIVEWAYS

80' R.O.W. FOUR MOVING LANES WITH 14' ESPLANADE

100' R.O.W. FOUR MOVING LANES WITH 34' ESPLANADE

120' R.O.W. FOUR MOVING LANES WITH 54' ESPLANADE
$L = \frac{W^2}{60}$ WHERE $W = (A - B)$ FT.

$S =$ SPEED LIMIT IN M.P.H.

$L =$ LENGTH IN FEET

---

Diagram showing a street with various radii ($R = 500'$, $R = 500'$, $R = 500'$, $R = 511'$) and angles ($20^\circ$, $20^\circ$, $20^\circ$) at different points along the street.
$L = \frac{WS^2}{60}$, WHERE $W = (A-B)$ FT.

$S =$ SPEED LIMIT IN M.P.H.

$L =$ LENGTH IN FEET
CUL-DE-SAC FOR RESIDENTIAL STREET

$R_1 = R_2 + 10'$
$R_2 = 25'$ MINIMUM
40' DESIREABLE
$R_3 = 26'$ MAXIMUM
CUL-DE-SAC R.O.W. RADIUS MUST
BE 60' WHEN ISLAND IS DESIRED
\[ R_1 = R_2 + 10' \]
\[ R_2 = 25' \text{ MINIMUM} \]
\[ 40' \text{ DESIREABLE} \]
\[ R_3 = 16' \text{ MAXIMUM} \]

* SEE PAGE 2 FOR DEFINITION
NOTES:

1. CULVERTS OVER 35' IN LENGTH REQUIRE PERMIT SECTION APPROVAL

2. FOR CULVERTS OVER 35' IN LENGTH, TYPE "D" INLETS TO BE INSTALLED ON CULVERTS AT A SPACING OF 33' CENTER TO CENTER.
DESIGN STANDARD FOR CUT-BACK FOR PARALLEL PARKING (ROADWAYS WITH CURB & GUTTER)

SECTION 1-1

PROPERTY LINE

PROPERTY LINE

SLOPE TO DRAIN OR PROVIDE INLETS

LIGHT STD. OR UTILITY POLE

SLOWCUT

SLOWCUT

SIDWALK

DIMENSION A
- 6" MINIMUM FROM END OF CURB RETURN
10" DESIRABLE

DIMENSION B
- 6'-6" MINIMUM
10" DESIRABLE

DIMENSION C
- 6'

DIMENSION D
- 6" MINIMUM
10" DESIRABLE

DETAIL E
- END OF CUT-BACK SHALL NOT EXTEND BEYOND SIDE PROPERTY LINE OF INTERSECTION

DIMENSION F
- 20' MINIMUM
15' DESIRABLE

DIMENSION G
- 10' MINIMUM

DETAIL H
- STANDARD CITY OF HOUSTON CURB MINIMUM HEIGHT 6"

S
- IF UNDER 6" BUILD WALL TO CURB

T
- 6" MINIMUM W/ 3/8" REF. BAR 84" CENTERS E.W.
FOR RESIDENTIAL USE

T
- 7" MINIMUM W/ 1/2" REF. BAR 84" CENTERS E.W.
FOR COMMERCIAL USE

E.W. = EACH WAY

CURB CUT-BACK FOR PARALLEL PARKING ONLY MAY BE AUTHORIZED AT LOCATIONS WHERE EITHER PARKING IS IMPROBABLE ALONG THE NORMAL CURB OR IN LOCATIONS WHERE THE NARROW WIDTH OF ROADWAY OR OTHER PHYSICAL LIMITATION MIGHT INDICATE THAT FOR TRAFFIC SAFETY PARKING CAN BE BETTER ACCOMMODATED IN CUT BACK.

PERMIT FROM PUBLIC WORKS DEPARTMENT REQUIRED FOR ANY WORK PERFORMED ON PUBLIC RIGHT-OF-WAY. WORK TO BE PERFORMED BY LICENSED CONTRACTOR ONLY, WITH APPROVED ENGINEERING PLANS.
THE WORD "STOP" SHALL NOT BE USED ON THE PAVEMENT UNLESS ACCOMPANIED BY A STOP LINE (SEC. 3B-14) AND STOP SIGN (SEC. 2B-4). THE WORD "STOP" SHALL NOT BE PLACED ON THE PAVEMENT IN ADVANCE OF A STOP LINE, UNLESS EVERY VEHICLE IS REQUIRED TO STOP AT ALL TIMES. PAVEMENT MESSAGES SHOULD GENERALLY BE NO MORE THAN ONE LANE IN WIDTH EXCEPT THE "SCHOOL" MESSAGES (SEC. 7C-6).

* MINIMUM SIZES FOR NORMAL INSTALLATION; LARGER SIZES MAY BE NEEDED FOR FREEWAYS, ABOVE AVERAGE SPEEDS, AND OTHER CRITICAL CONDITIONS FOR PROPER PROPORTION, SEE STANDARD ALPHABETS FOR HIGHWAY SIGNS AND PAVEMENT MARKINGS (AVAILABLE FROM FHWA, HTO-20, WASHINGTON, D.C. 20590.)
**NOTE:**

DIMENSION "A" SHALL BE DETERMINED BY THE VOLUME OF LEFT TURN TRAFFIC TO BE ACCOMMODATED

DIMENSION "W" SHALL BE DETERMINED BY THE STREET WIDTH AVAILABLE FOR MOVING TRAFFIC

---

<table>
<thead>
<tr>
<th>S (MPH)</th>
<th>W</th>
<th>10'</th>
<th>11'</th>
<th>12'</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>L</td>
<td>45</td>
<td>55</td>
<td>65</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td>65</td>
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<tr>
<td>45</td>
<td></td>
<td>135</td>
<td>160</td>
<td>180</td>
</tr>
</tbody>
</table>

* NUMBERS ARE ROUNDED TO NEAREST 5 FT.

\[ L = \frac{BS}{60} \text{ FOR SPEED OF 40 MPH OR LESS} \]

\[ L = \frac{BS}{60} \text{ FOR SPEED OF 45 MPH OR MORE} \]

WHERE: \( B = \frac{S}{3} \)

\( S = \text{APPROACH SPEED IN MPH} \)