Ketchikan Gravina Island Access

HP-NCPD-922(5) / 67698

Roadway and Bridge Design Criteria Technical Memorandum

A Gateway to the Future
Gravina Access

Prepared for:

Department of Transportation and Public Facilities
Southeast Region

Prepared by:

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STATE OF ALASKA
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6.24.05

July 29, 2004
amended June 2005

KETCHIKAN GRAVINA ISLAND ACCESS

Introduction

This memorandum describes the design criteria for evaluation of the preferred alternative being considered to improve access between the city of Ketchikan on Revillagigedo (Revilla) Island and Gravina Island. The Project has been studied several times in the past, resulting in various proposed alignments for bridge and tunnel crossings, as well as increased use of ferry service. The *Design Criteria Technical Memorandum* shall be used as the basis for developing and evaluating design parameters for the preferred crossing, *Alternative F1*; the engineering evaluation to support obtaining permits; and for subsequent design and implementation. These design criteria revise the earlier October 2001 draft submission, and update minor items from the July 29, 2004, approval.[1]

Project Description

This Project is intended to provide roadway access from Ketchikan to Gravina Island across the two channels of the *Tongass Narrows*, an active waterway used by vessels that range in size from recreational craft to ocean-going vessels such as large cruise ships. The large vessels will ultimately dictate the navigational opening; but the presence of *Ketchikan International Airport* (KIA) and floatplanes may also restrict the potential height of any crossing. The waterway is an active floatplane operations area as well, particularly during the summer months.

The Department has designated this route between the City and the KIA to be a part of the National Highway System (NHS), the highest, most important of roads in our network.

References

A list of applicable design standards and specifications is provided in *References* section at the end of this document.

Roadway Design Criteria

The roadway design criteria for the Gravina Access Highway were developed from the AASHTO Policy on Geometric Design of Highways and Streets, 2001, as amended by the Department's current edition of the Alaska Preconstruction Manual. The work is being funded by a combination of local, State, and Federal-aid monies, the majority of which is from congressional appropriation specifically for this Project.

The Ketchikan Gateway Borough population is expected to grow to between approximately 14,700 and 25,800 by 2030.[2] The Gravina Access Highway is anticipated to attract over 8,900 trips daily between downtown Ketchikan and their Airport and economic development area on Gravina Island by the design year. This assumes a conservative medium

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[1] June 2005 revision, MRT
[2] June 2005 revision, CWC

economic growth rate in the Borough, the basis for this traffic analysis.[3] A higher growth rate will not significantly change the design standards recommended for this improvement. The following are the *Alternative F1* traffic projections across *Tongass Narrows*:

	Low Economic Activity	Medium Economic Activity	High Economic Activity
Population in 2025[4]	14,000	18,300	24,500
One-Way Trips in 2025[5]	2,100	4,200	6,700
2030 ADT[6]	4,400	8,900	14,100

The Design Hourly Volume, the figure used to determine size of a roadway, is proposed to be 10 percent, or about 900 cars per hour. With a directional split of 45%/55% (PM peak to/from Gravina), a rural two-lane facility will adequately handle this amount of traffic at a Level-of-Service “B” through the design year.

An access that links intracity travel between the downtown and the airport is usually considered a minor arterial. The functional classification of an arterial roadway will set the design standards to be used for this facility.

AASHTO recommends that a rural arterial should also have minimum interference to the through movement.[7] With this in mind, it is recommended that the new corridor be acquired as controlled-access, with the intersection locations a minimum of 1-mile apart, and identified before right-of-way acquisition.

The key design elements will be the lanes, shoulders and pedestrian accommodations, and the structural needs of the bridge. Revilla Island has steep mountainous terrain with fairly intense development on the buildable land. Pennock Island is mountainous and undeveloped except along the shoreline. The land across Gravina Island is undeveloped rural rolling/mountainous topography pocketed by boggy areas that is anticipated to provide the future growth expansion area for Ketchikan. Topography will dictate the maximum grades for the roadway.

The recommended typical section is two 12-foot driving lanes with 8-foot shoulders for a total roadway width of 40-feet. A rural typical section with ditches is envisioned from the Tongass Highway on Revilla Island, across Pennock Island, and ending at the Airport. Because of the deep rock cut above the tank farm on Revilla Island, this section will be reevaluated during the design phase after further detailed geotechnical investigation.

[3] Gravina Access Project *Environmental Impact Statement*, 2004, page 4-130
[4] HDR *Traffic Assessment Technical Memorandum*, November 2002, page 4-5
[5] HDR *Traffic Assessment Technical Memorandum*, November 2002, page 2
[6] June 2005 revision, CWC
[7] AASHTO Policy on Geometric Design of Highways and Streets, 2001, page 9

The non-motorized public will utilize the 8-foot walkway on the north side of the bridges for the viewshed; beyond the bridges, pedestrian and bicycle travel can be accommodated on the shoulders of the roadway.

Clearances

Roadway clearances for the approaches to the KIA and the *Tongass Narrows* seaplane channel will meet the requirements of the Federal Aviation Administration (FAA) Part 77, Objects Affecting Navigable Airspace. Structure types will require an FAA determination on the viability of Exemption 4760 which allows some pilots to fly below the minimum flight ceiling in Ketchikan's Class E airspace.

Shipping clearances will be governed by the type of vessel usage. The east channel of Tongass Narrows is navigated by large vessels of the cruise ship industry, the tallest of which is governed by the class of vessels currently in Seattle and Southeast Alaska service. They are all of the size that use the Inside Passage, and are controlled by the vertical clearance of Lyons Gate bridge in Seymour Narrows, Vancouver, BC. The navigational envelope will be 200-feet above mean higher high water (MHHW) by a horizontal clear span of 550-feet for one-way shipping. The minimum depth of the channel below mean lower low water (MLLW) will be 40 feet.

The west channel is primarily used by ferries of the *Alaska Marine Highway System* (AMHS), and requires a vertical clearance of 120-feet above MHHW. The horizontal clear span will be 500-feet for two-way traffic. The vertical depth below MLLW will also be 40-feet.

Tracklines for the east channel were provided by the *Southeast Alaska Pilots Association*, and for the west channel by the AMHS Port Captain.

Future Considerations

Care must be taken to insure that the future development on Gravina Island does not result in a structure that cannot handle the traffic without an alternative plan for addressing demand past the 20-year horizon, but still within the 75 year useful life of the structure.[8] The current lane assignment and pedestrian facility will result in a minimum bridge width of 48-feet between the railings. This could yield a reversible 3-lane and walkway, or four 11-foot lanes with 2-foot shy in the future.

A 12-foot separated pathway within the roadway corridor on Gravina and Pennock Islands should also be planned for construction at a future date. The alignment can be detailed and the property acquired so that the facility will not precluded. Consideration should also be given to a corridor reservation that would accommodate a multi-lane facility and frontage roads.

[8] HDR *Gravina Access Alternatives Evaluation Summary Report*, January 2002, page 10

Bridge Design Criteria

1. General

1.1. Bridge Names and Numbers

1.1.1. Tongass Narrows Bridge – East Channel — Bridge Number 1254

1.1.2. Tongass Narrows Bridge – West Channel — Bridge Number 2153

1.2. Applicable Design Codes and Specifications

Unless modified by these criteria, this Project shall be designed based upon the American Association of State Highway and Transportation Officials (AASHTO) *Load and Resistance Factor Design Specifications, 2004*, and the citations listed in the *References* section at the end of this document. Analysis, design and detailing elements not specifically referenced in these criteria shall be based upon the AASHTO LRFD Specifications.

2. Design Loads

2.1. General

2.1.1. Load Factors and Combinations — per AASHTO LRFD 3.4

2.2. Segmental Design

2.2.1. Construction Loads — per AASHTO LRFD 5.14.2.3.2

2.2.2. Construction Load Combinations — per AASHTO LRFD 5.14.2.3.3 and 5.14.2.3.4

2.3. Permanent Loads

2.3.1. Dead Loads, DC — per AASHTO LRFD 3.5 except for the following:

2.3.1.1. Concrete (Pre-Stressed (P/S) and Reinforced Concrete): — 160 pcf (includes reinforcement)

2.3.1.2. Bridge Railing (each): — 350 plf (to be verified)

2.3.2.	Wearing Surface and Utilities, DW	per AASHTO LRFD 3.5
2.3.2.1.	4 inches of asphalt wearing surface	46.7 psf (140 pcf)
2.3.2.2.	Utility Allowance	350 plf

2.4. Live Loads

2.4.1.	Number of Lanes	per AASHTO LRFD 3.6.1.1.1 – Bridges will be designed for the as constructed condition (40 foot roadway w/ 8 foot sidewalk) and the future condition (48 foot roadway w/ no sidewalk, whichever produces the maximum loadings in the members.
2.4.2.	Multiple Presence of Live Load, m	per AASHTO LRFD 3.6.1.1.2 – consider the simultaneous presence of vehicular and pedestrian loads.
2.4.3.	Design Vehicular Live Load, LL (HL-93)	per AASHTO LRFD 3.6.1.2
2.4.4.	Non-Restricted Overload, INV	Consideration shall be given to loading due to overload vehicles simultaneously using the structure with standard live loads. Capacity check shall be made under the “Strength II” category as outlined in AASHTO LRFD 3.4.1 and simultaneous application of these loads shall be as outlined in AASHTO LRFD 4.6.2.2.4.
2.4.5.	Restricted Overload, OPR	Consideration shall be given to possible overload vehicles that may use the structure (logging / mining support, airport / aircraft maintenance, etc). Restricted overload vehicles may be considered without the presence of standard live loads. Loading to be determined.
2.4.6.	Fatigue Load	per AASHTO LRFD 3.6.1.4

2.4.7.	Pedestrian Loads, PL	per AASHTO LRFD 3.6.1.6
2.4.8.	Dynamic Load Allowance, IM	per AASHTO LRFD 3.6.2
2.4.9.	Centrifugal Forces, CE	per AASHTO LRFD 3.6.3
2.4.10.	Braking Force, BR	per AASHTO LRFD 3.6.4
2.4.11.	Live Load Surcharge, LS	per AASHTO LRFD 3.11.6.4

2.5. Earth Pressure

2.5.1.	Lateral Earth Pressure, EH	per AASHTO LRFD 3.11.5 except for the following:
2.5.1.1.	Unit weight of soil	provided by geotechnical engineer - for preliminary design use 130 pcf
2.5.1.2.	Internal Friction Angle for Granular Fill (F)	provided by geotechnical engineer - for preliminary design use 32°
2.5.2.	Vertical Earth Pressure, EV	per AASHTO LRFD 3.11
2.5.3.	Downdrag, DD	per AASHTO LRFD 3.11.8

2.6. Force Effects from Superimposed Deformations

2.6.1.	Uniform Temperature	per AASHTO LRFD 3.12.2 except for the following:
2.6.1.1.	Setting Temperature	50˚F
2.6.1.2.	Concrete Structures:	
	• Temperature rise:	35˚F
	• Temperature fall:	45˚F
	• Temperature Range:	5˚F to 85˚F
2.6.1.3.	Steel Structures:	
	• Temperature rise:	45˚F
	• Temperature fall:	50˚F
	• Temperature Range:	0˚F to 95˚F
2.6.1.4.	Coefficients of Thermal Expansion (α)	
	• Concrete:	per AASHTO LRFD 5.4.2.2
	• Steel:	per AASHTO LRFD 6.4.1

2.6.1.5. Temperature Gradient

- Longitudinal Box Temperature Gradient: per AASHTO LRFD 3.12.3
- Transverse Box Temperature Differential: The superstructure box girder shall be designed transversely for a temperature differential between the inside and outside surfaces of ±10 ºF with no reduction in modulus of elasticity.

2.7. Water Loads

2.7.1. Buoyancy — per AASHTO LRFD 3.7.2

2.7.2. Stream Pressure, WA — per AASHTO LRFD 3.7.3

2.7.3. Design Water Velocity: — To be determined – Use 5 ft/s for preliminary work

2.7.4. Scour — per AASHTO LRFD 3.7.5 and Alaska Preconstruction Manual Section 1120

2.7.5. Scour Depth: — To be determined – For preliminary work, assume soils not classified as rock are prone to scour.

2.8. Wind Loads

2.8.1. Wind Return Period — 100 Year

2.8.2. Design Wind Speed — Site specific wind studies will be conducted for this Project. Wind data from the site will be correlated with the historic data that exists for the KIA. Wind speed will be determined from the study. Design criteria for wind loading will be refined during the preliminary design phase. Final recommendations for wind loadings will be addressed in a separate technical memorandum.

2.8.3.	Wind Pressure on Structure, WS	per site specific wind study. However, not less than the Base Pressure, P_B defined in AASHTO LRFD Table 3.8.1.2.2-1
2.8.4.	Wind Pressure on Vehicles, WL	per AASHTO LRFD 3.8.1.3
2.8.5.	Vertical Wind Pressure	per AASHTO 3.8.2
2.8.6.	Aeroelastic Instability	To be determined

2.9. Ice Loads

2.9.1.	Effective Ice Strength	Use 8 KSF per AASHTO LRFD 3.9.2.1
2.9.2.	Horizontal Ice Load, IC	per AASHTO LRFD 3.9.2.2
2.9.3.	Vertical Ice Load	per AASHTO LRFD 3.9.5
2.9.3.	Snow Loads	To be determined – based on Ketchikan's maritime climate, heavy snow buildup is not expected.

2.10. Vessel Collision

2.10.1.	Design Vessel	per AASHTO LRFD 3.14 and the Monte Carlo Navigation Simulation Technical Memorandum (The Glosten Associates, October 2001).
2.10.2.	Vessel Collision, CV	per AASHTO LRFD 3.14
2.10.3.	Pier Protective Systems	Protective structures such as pile supported fenders, rock-filled islands and rock-filled dolphins will not be used.

2.11. Earthquake Effects

2.11.1.	Design Codes	The *Tongass Narrows* bridges shall be designed for the force effects as outlined in the AASHTO LRFD code. Displacement demands and ductility checks shall be performed according to Caltrans SDC Version 1.3 and

	ATC-32 and as stated this document.[9]
2.11.2. Bridge Category	Critical Bridge per AASHTO LRFD 3.10.3; Important Bridge per Table R3-1 ATC-32[10]
2.11.3. Design Events:	
2.11.3.1. Service (Functional) Level	475 year return period, 10% probability of exceedance in 50 years
2.11.3.2. Safety Level	2500 year return period, 2% probability of exceedance in 50 years)
2.11.4. Acceleration Coefficients:	
2.11.4.1. Service (Functional) Level	PGA_{475}=0.08 (Use 0.1 for preliminary design).
2.11.4.2. Safety Level	PGA_{2500}=0.18 (Use 0.2 for preliminary design). PGA based on 1999 USGS seismic hazard maps. PGA values to be verified in future geotechnical study.
2.11.5. Horizontal Ground Motions	Method 1 per SDC 2.1.2
2.11.6. Vertical Ground Motions	None, to be verified in future geotechnical study.
2.11.7. Estimated Displacement Demand	per SDC 2.2.1 using Elastic Dynamic Analysis.
2.11.8. Displacement Ductility Demand	per SDC 2.2.3 & 2.2.4 except:
2.11.8.1. Service Level Event	$\mu_D \leq 1$ using expected material properties for all components.
2.11.8.2. Safety Level Event	$\mu_D \leq 3$
2.11.9. Local Member Displacement Capacity	per SDC 3.1.3

[9] June 2005 revision, DS
[10] June 2005 revision, JES

2.11.10. Local Member Displacement Ductility Capacity	$\mu_C \geq 3$ (target) per SDC 3.1.4. Target value will be verified in future studies.
2.11.11. Material Properties for Concrete Components	per SDC 3.2
2.11.12. Plastic Moment Capacity for Ductile Concrete Members	per SDC 3.3
2.11.13. Requirements for Capacity Protected Components	per SDC 3.4
2.11.14. Shear Design for Ductile Concrete Members	per SDC 3.6
2.11.15. Lateral Reinforcement of Ductile Members	per SDC 3.8
2.11.16. Global Displacement Criteria	per SDC 4.1.1 except:
2.11.16.1. Service Level Event	$\Delta_D < \Delta_Y$
2.11.16.2. Safety Level Event	$\Delta_D < 0.7\Delta_C$
2.11.17. P-Δ Effects	per SDC 4.2
2.11.18. Column Overstrength Factors	per SDC 4.3
2.11.19. Seismic Analysis	per SDC 5
2.11.20. Seismicity and Foundation Data	per SDC 6
2.11.20.1. Elastic Seismic Response Coefficient	per AASHTO LRFD 3.10.6
2.11.20.2. Soil Classification	Soil Profile Type in ATC-32 Table R3-3 to be determined in future geotechnical study. For preliminary design use Soil Profile Type B.
2.11.21. Seismic Design	per SDC 6 & 7
2.11.22. Seismic Detailing	per SDC 8

3. Structural Analysis

3.1. Mathematical Modeling

per AASHTO LRFD 4.5

3.2. Static Analysis

per AASHTO LRFD 4.6

3.2.1. Decks

AASHTO LRFD empirical design method shall not be used.

3.2.2. Live Load Deflection Limitations

Use Span/1000 per AASHTO LRFD 2.5.2.6.1

3.3. Dynamic Analysis

per SDC

4. Concrete Structures

4.1. Material Properties

4.1.1. Concrete

per AASHTO LRFD 5.4.2

4.1.1.1. Compressive Strength

Element	Class	F'_c (Strength)
Segmental Box Girder	A-A	6500 psi
Columns	A	5000 psi
All other Concrete	A	4000 psi

4.1.1.2. Relative Humidity

Use 80%

4.1.2. Reinforcing Steel

per AASHTO LRFD 5.4.3. Use ASTM A-706 "Low Alloy Steel Deformed Bar for Concrete Reinforcement".

4.1.3. Prestressing Steel

per AASHTO LRFD 5.4.4

4.1.3.1. Strand

Use Grade 270 Low Relaxation Strand

4.1.3.2. Bar

Use Type 2, Deformed Bar

4.1.4. PT Anchorages & Couplers

per AASHTO LRFD 5.4.5

4.1.5. Ducts

per AASHTO LRFD 5.4.6. Use polyethylene ducts.

4.2. Limit States

per AASHTO LRFD 5.5

4.3. Design Considerations

per AASHTO LRFD 5.6

4.4.	**Design for Flexural & Axial Forces**	per AASHTO LRFD 5.7
4.4.1.	Crack Control	Use severe exposure for all concrete
4.5.	**Shear and Torsion**	per AASHTO LRFD 5.8
4.6.	**Prestressing & Partial Prestressing**	per AASHTO LRFD 5.9
4.6.1.	Anchorage Set – Strand	Use 3/8-inch
4.6.2.	Anchorage Set – Bar	Use 1/16-inch
4.6.3.	Time Dependent Losses	per AASHTO LRFD 5.9.5.4. May use AASHTO LRFD Table 5.9.3-1 for preliminary design.
4.6.4.	Posttensioned Webs	Principal stresses shall be limited to 3.5 $\sqrt{f'_c}$.
4.7.	**Detailing of Reinforcement**	per AASHTO LRFD 5.10
4.8.	**Development & Splices of Reinforcement**	per AASHTO LRFD 5.11
4.9.	**Durability**	per AASHTO LRFD 5.12
4.9.1.	Epoxy Coated Reinforcement	Use epoxy coated bar in concrete members within 1 foot vertically of driving surface
4.9.2.	Deck Protection	Use waterproof membrane on deck with 4 inch asphalt overlay
4.9.3.	Concrete Cover	per AASHTO LRFD 5.12.3. Provide 2.5 inch cover over all deck surfaces.[11]
4.9.4.	Grout in PT Duct	All PT ducts shall be grouted. Corrosion inhibiting additives, like calcium nitrate, shall be considered.
4.9.5.	Exposed Structural Steel	Galvanize all exposed structural steel components

[11] June 2005 revision, DS

4.9.6.	Concrete Additives	NTD, consider use of fly ash or other additives in critical concrete members.

4.10. Specific Members — per AASHTO LRFD 5.13

4.11. Provisions for Structure Members — per AASHTO LRFD 5.14

4.11.1.	Construction Loads	Assume 250 kips for the form traveler with CG 10 feet beyond the supporting segment face.
4.11.2.	Cantilever Construction	Wind velocity during construction will be determined in future site specific wind study. Use 55 MPH for preliminary design.
4.11.3.	Construction Load Combinations	per AASHTO LRFD 5.14.2.3.3 & 5.14.2.3.4. Do not use load factors in AASHTO LRFD 3.4.2.

5. Foundations — per AASHTO LRFD Chapter 10

6. Abutments, Piers and Walls — per AASHTO LRFD Chapter 11

7. Railings — per AASHTO LRFD Chapter 13

7.1. Test Level — per NCHRP Report 350, TL-4

8. Joints and Bearings

8.1. Movements and Loads — per AASHTO LRFD 14.4

8.2. Joints — per AASHTO LRFD 14.5

8.3. Bearings — per AASHTO LRFD 14.6. ~~Use pot or Disc Bearings.~~[12]

[12] June 2005 revision, DS

DESIGN DESIGNATION

State Route Number: ________ Route Name: *Gravina Access Highway*

Project Limits: *Ketchikan to Ketchikan International Airport*

State Project Number: 67698 Federal Aid Number: HP-NCPD-922(5)

Project Description: *Construction of improved road access from City of Ketchikan on Revilla Island, across Pennock Island, to the KIA on Gravina Island.*

Design Functional Classification: Urban Arterial ☐ Rural Arterial ☑ Major Collector ☐ Minor Collector ☐ Local ☐

New Construction - Reconstruction ☑ Rehabilitation (3R) ☐ Other: _____

Project Design Life (years): 5 ☐ 10 ☐ 20 ☑ 25 ☐ Other: ________

	Existing Year	Construction Year	Mid–Life Year	Future Year
ADT:	0			8,900
DHV:	0			10 %
Direction Distribution:				45/55 %
Percent Recreational Vehicles:				
Percent Commercial Trucks:				2 %
Compound Growth Rate:				
Pedestrians (Number/Day):				< 100
Bicyclists (Number/Day):				< 200

Design Vehicles for Turning: *AASHTO WB-67, Tractor-Trailer*

Design Vehicle Loading: ☐ HS15 ☐ HS20 ☐ HS25 ☑ Other: HL-93

Equivalent Axle Loads (EALs): ________

PROPOSED: [signature] 24 JUNE 2005
Michael R. Tooley, HDR Alaska — Date

ACCEPTED: [signature] 6.27.05
Chris Morrow, PE, Director, Construction, M&O — Date

June 2005 revision

PROJECT DESIGN CRITERIA

Project: Ketchikan Gravina Island Bridge Access		
New Construction / Reconstruction ☑	Rehabilitation (3R) ☐	Other:
Design Functional Classification:	Rural Minor Arterial (GB, pages 9 and 447)	
Terrain:	Rolling / Mountainous	
Level-of-Service:	"C", stable flow (GB, pages 85 and 448)	
Design Year:	2030	
Present Year ADT:	0	
Design Year ADT:	8,900	
DHV (10%):	890	
Directional Split (D, 45/55%):	400/490	
Trucks (PTT, 2%):	178	
Design Vehicle:	WB-67, Tractor-Trailer (Doerflinger 6-1-00 email)	
Design Speed:	50mph desirable, 40mph minimum (GB, page 448)*	
Stopping Sight Distance:	425 feet desirable, 305 feet minimum (GB, Exhibit 7-1)	
Passing Sight Distance:	1835 feet desirable, 1470 feet minimum (GB, Exhibit 7-1)	
Maximum Allowable Grade:	7 percent desirable, 8 percent maximum (GB, Exhibit 7-2)	
Minimum Allowable Grade:	0.3 percent (PCM, Table 1120-1)	
Minimum Radius of Curvature:	835 feet desirable, 510 feet minimum (GB, Exhibit 3-22)	
Minimum K-value for Vertical Curves:	Sag (GB, Exhibit 3-79)	Crest (GB, Exhibit 3-76)
	96 desirable, 64 minimum	84 desirable, 44 minimum
Width of Traveled Way:	12 feet (GB, Exhibit 7-3)	
Width of Shoulders:	8 feet (GB, Exhibit 7-3)	
Surface Treatment:	Traveled Way	Shoulders
	Pavement	Pavement
Side Slope Ratios:	Foreslopes	Backslopes
	4:1 (28' clear zone)	3:1 (PCM Table 1130-8)
Degree of Access Control:	Controlled-access (GB, page 9)	
Illumination:	Intersection illumination	
Curb Usage and Type:	Mountable, intersection channelization	
Pedestrian Provisions:	8 feet on the main bridges (GB, page 362)	
Bicycle Provisions:	on the shoulders	
Pathway:	12 feet in future (PCM Table 1210-1)	
Miscellaneous Criteria:	*20mph, urban arterial (intersection) (GB, page 41)	

* n is the number of years of expected pavement design life.

PROPOSED: [signature] 24 June 2005
Michael R. Tooley — Date
HDR Alaska

ACCEPTED: [signature] 6-27-05
Chris Morrow, PE — Date
Director, Construction, M&O

June 2005 revision

BRIDGE DESIGN CRITERIA

Project: Ketchikan, Gravina Island Bridge Access

New Construction / Reconstruction ☑ Rehabilitation (3R) ☐ Other:

Design Year:	2085 -75 year design life, assume construction done 2010
Bridge Loading:	HL-93
Design Standards:	AASHTO *Load and Resistance Factor Design Specifications, 2004*, as modified herein
Seismic Acceleration Coefficient:	PGA_{475}=0.08 & PGA_{2500}=0.18 (Use 0.1 & 0.2 for preliminary design) - Values to be confirmed during geotechnical phase.
Wind Load:	To be determined - Reference text
Miscellaneous Criteria:	

PROPOSED: [signature] 6-24-05
John E. Sherk, PE Date
HDR Alaska

ACCEPTED: [signature] FOR 6/27/5
Richard A. Pratt, PE Date
Chief Bridge Engineer

June 2005 revision

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12. ADOT&PF. *Highway Drainage Manual*, 1995.
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16. ANSI/AASHTO/AWS *Bridge Welding Code D1.5-2002* with 2003 Interim
17. ATC-32 *Improved Seismic Design Criteria for California Bridges: Provisional Recommendations,* 1996.
18. AWS D1.1 *2004 Structural Welding Code – Steel*
19. *CEB-FIP Model Code for Concrete Structures*, 3rd Edition 1990, Appendix E, Time Dependent Behavior of Concrete, Creep and Shrinkage.
20. CalTrans. *Seismic Design Criteria Version 1.3* – February 2004