

**SurvBase PMRail GRS80
Coordinate System
Parameters
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Introduction

PMRail GRS80 is a low distortion Transverse Mercator projection plane coordinate system suitable for engineering, boundary development, property acquisition, and use in geographic information systems (GIS).

The coordinate system encompasses the Port MacKenzie Rail Extension alternate routes as well as the proposed Knik Arm Bridge and Toll Authority's project.

Parameters

Coordinate System Name: **PMRail GRS80**

Projection: **Transverse Mercator**

False Northing: **500 000**

False Easting: **100 000**

Origin Latitude: **61°00'00" North**

Central Meridian: **150°00'00" West**

(Note: if the software you are using is looking for a purely numeric entry – no "W" - this will be entered as -150)

Ellipsoid: **GRS80**

(Note to AutoCAD users: AutoCAD doesn't properly define the "pure" GRS80 ellipsoid – the workaround is to use the parameters below on Pages 6 & 7)

Units: **US Survey feet (fts)** = 1200 / 3937 meters

Assigned Project Scale Factor (SF) at Central Meridian = **1.000 004**

Vertical will be NAVD88 based on GEOID06 – details will be issued separately.

Coordinate System Limits:

N 61° 51'
S 61° 00'
E 149° 30'
W 150° 30'

Port MacKenzie is at:

N 61°16'
W 149°55'

Scale Factor Information

The coordinate system is designed to have 0 scale factor error at the central meridian 90' above the GRS80 ellipsoid.

Average Project Orthometric Height = Approx 70'

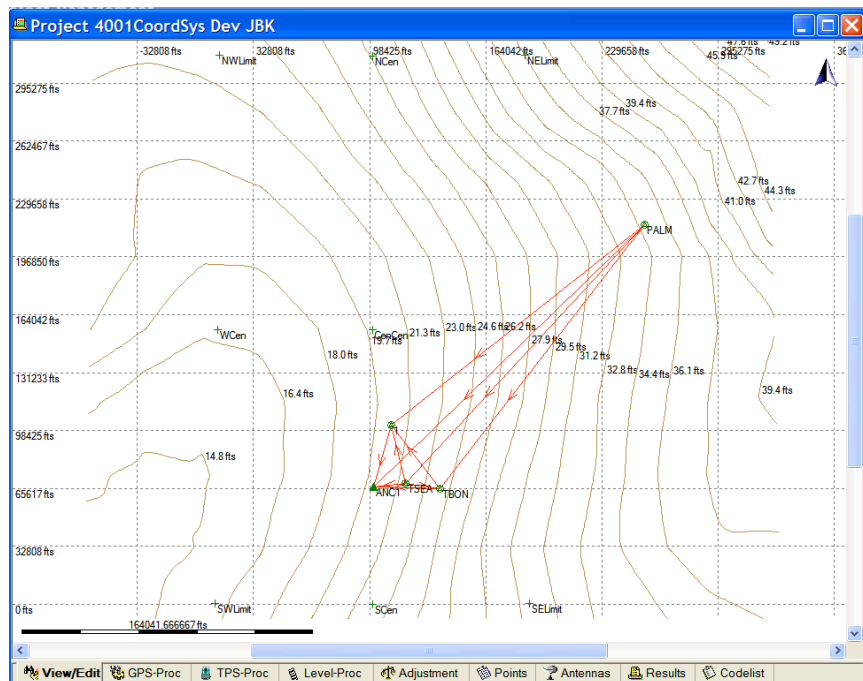
Average Geoid06 Separation in the project area is approximately 20'

Target Projection Ellipsoid Height = 90'

Mean Radius @ 60° Lat is approximately 20,961,000

For an ellipsoid ht of approximately 84' $20961084/20961000 = \text{Target Ground to Grid}$
Scale Factor = **1.000 004** (rounded)¹

Assigned Project SF at Central Meridian = **1.000 004** -exact-



Geoid Separation Contour Map

¹ For a scale factor = 1 the cylinder is tangent to the sphere (ellipsoid), for a scale factor < 1 it is secant. Secant means the cylinder intersects the sphere along two straight lines equidistant from the central meridian. In this case the scale is true (1) along these two straight lines.

100-ft change in height causes a 4.8 ppm change in distortion or .03'/mile

Sample Coords

Project 4001CoordSys Dev JBK									
Point Id	Point ...	Date/Time	Northing	Easting	Ortho. Hgt.	Ellip. Hgt.	Posn. + Hgt. Qlty	Code	
<input checked="" type="checkbox"/> CenCen	Estimated	11/04/2008 16:58:10	655377.1831	100000.0000	80.1614	100.0003	0.0000		
<input checked="" type="checkbox"/> NCen	Estimated	11/04/2008 16:59:20	810764.1391	100000.0000	173.6394	200.0003	0.0000		
<input checked="" type="checkbox"/> NELimit	Estimated	11/04/2008 17:01:03	811096.4526	186376.9843	163.8632	200.0003	0.0000		
<input checked="" type="checkbox"/> NWLimit	Estimated	11/04/2008 17:01:32	811096.4526	13623.0157	178.0295	200.0003	0.0000		
<input checked="" type="checkbox"/> SCen	Estimated	11/04/2008 16:58:50	500000.0003	100000.0000	-22.0207	0.0003	0.0000		
<input checked="" type="checkbox"/> SELimit	Estimated	11/04/2008 17:00:08	500338.7282	188758.5675	-30.0525	0.0003	0.0000		
<input checked="" type="checkbox"/> SWLimit	Estimated	11/04/2008 17:00:36	500338.7282	11241.4325	-15.8330	0.0003	0.0000		
<input checked="" type="checkbox"/> WCen	Estimated	11/04/2008 17:03:08	655712.7408	12429.7815	83.5505	100.0003	0.0000		
<input checked="" type="checkbox"/> TLKA	Navigated	11/01/2008 10:59:46	978333.1811	28480.7355	513.0278	543.0697	0.0000		
<input checked="" type="checkbox"/> 20	Averaged	11/04/2008 11:25:42	772348.7818	91754.8426	220.7992	244.8158	0.0464	MN	
<input checked="" type="checkbox"/> 40	Averaged	11/04/2008 15:13:11	683868.4891	101974.6541	-	259.1550	0.0445	MN	
<input checked="" type="checkbox"/> 50	Averaged	11/04/2008 14:42:44	685804.2011	101951.1979	-	199.4726	0.0258	MN	
<input checked="" type="checkbox"/> 70	Averaged	11/04/2008 17:32:39	605496.2070	101213.0840	-	173.7032	0.0348	MN	
<input checked="" type="checkbox"/> 80	Averaged	11/04/2008 17:55:55	605533.5570	104780.0496	-	151.4111	0.0441	MN	
<input checked="" type="checkbox"/> 10	Reference	11/04/2008 11:19:15	775311.3584	89913.8174	204.3565	228.3771	0.0000		
<input checked="" type="checkbox"/> 30	Reference	11/04/2008 14:40:50	683838.9270	101955.8181	-	259.5528	0.0000		
<input checked="" type="checkbox"/> 60	Reference	11/04/2008 17:30:28	605523.7261	104827.2855	-	151.3012	0.0000		
<input checked="" type="checkbox"/> 1	Adjusted	11/05/2008 17:13:07	601739.8196	110739.7244	311.9825	332.3604	0.0170	ACAP	
<input checked="" type="checkbox"/> ANC1	Adjusted	11/05/2008 17:13:07	566675.6690	100574.1695	131.2665	151.2930	0.0227		
<input checked="" type="checkbox"/> PALM	Adjusted	11/05/2008 17:13:07	715177.3812	253500.6586	230.5226	265.1263	0.0170		
<input checked="" type="checkbox"/> TBON	Adjusted	11/05/2008 17:13:07	565764.2666	137930.2810	280.2453	304.1990	0.0096		
<input checked="" type="checkbox"/> TSEA	Control	11/05/2008 17:00:29	568498.9546	118538.3812	117.7587	139.4913	0.0000		

View/Edit
 GPS-Proc
 TPS-Proc
 Level-Proc
 Adjustment
 Points
 Antennas
 Results

Ground Based Coordinate System Verification

EDM vs. GPS Checks

Nancy Lake

Test Points: 10 & 20

Ortho Ht 10 = 204.36
 20 = 220.80

EDM Horizontal Dist = 3488.010

RTK Dist (Grid on PortMac Rail G06) = 3488.013

RTK Horizontal Dist (Ground on PortMac Rail G06) = 3488.038

(Grid LGO = 3488.013)

(Grid TGO = 3488.012)

EDM-Grid Dist Diff = Diff = 0.003

Comp'd Distortion 1: 1,162,666

Susitna Parkway (S. Big Lake)

Test Points: 40 & 50

Ortho Ht 40 = 238.58
 50 = 178.85

EDM Horizontal Dist = 1935.883

RTK Horizontal Dist (Grid on PortMac Rail G06) = 1935.854

(Ground on PortMac Rail G06) = 1935.868

(Grid LGO = 1935.8542)

(Grid TGO = 1935.855)

EDM-Grid Dist Diff = Diff = 0.029

Comp'd Distortion 1: 66,754

Port Mac

Test Points: 70 & 80

Ortho Ht 70 = 154.15
 80 = 131.57

EDM Horizontal Dist = 3567.175

RTK Horizontal Dist (Grid on PortMac Rail G06) = 3567.161

(Grid LGO = 3567.1611)

(Ground on PortMac Rail G06) = 3567.175

(Grid TGO = 3567.161)

EDM-Grid Dist Diff = 0.014

Comp'd Distortion 1: 254,798

Properties as shown in various software

As shown in **Leica Geomatics Office (LGO)** – LGO is the Baseline for definition and checks

Project Properties [?] [X]

General | Coordinates | Dictionary | Background Image | Codelist Template

Coordinate System: PMRail GRS80 [View...]

Transformation: -

Residuals: No distribution

Local ellipsoid: GRS 1980 Geoid model: Geoid06LS

Projection: PortMac TM LDP CSCS model: -

☐ Compute modified grid coordinates:

Average combined factor: 1.0

Northing shift: 0.0 fts

Easting shift: 0.0 fts

[OK] [Cancel]

.....

Coordinate System as shown in **AutoCAD**

Define Global Coordinate System [X]

General | Projection

Code: PMRail GRS80 Units: Foot [v]

Description: Port Mac Rail Ext GRS80 NAD83 TM US Survey Foot

Coordinate System Type

☒ Geodetic

Datum: NAD 1983, Alaska, Canada, Continental US, Mexico, Central America

[Select...] [Define...]

☐ Non-geodetic

Ellipsoid:

[Select...] [Define...]

[OK] [Cancel] [Help]

Define Global Coordinate System

General Projection

Projection:
Transverse Mercator

False Origin
Northing: 500000 Easting: 100000

Projection Parameters
Origin latitude: 61d0'0.000000"
Scale reduction: 1.000004
Central meridian: -150d0'0.000000"

OK Cancel Help

Global Coordinate System Manager

Category:
USA, Alaska Category Manager...

Coordinate Systems in Category:

- NAD83 datum, Alaska State Planes; Zone 8, Meter
- NAD83 datum, Alaska State Planes; Zone 8, US Foot
- NAD83 datum, Alaska State Planes; Zone 9, Meter
- NAD83 datum, Alaska State Planes; Zone 9, US Foot
- NAD83 datum, Alaska State Planes; Zone 10, Meter
- NAD83 datum, Alaska State Planes; Zone 10, US Foot
- NAD27 Modified Sterographic for Alaska, Meter
- NAD27-AK.LL Automatically generated LL system for WKT use.
- NAD83 Modified Sterographic for Alaska, Meter
- Port Mac Rail Ext WGS84 TM US Foot
- Port Mac Rail Ext GRS80 NAD83 TM US Survey Foot

Define... Modify... Remove

Close Help

.....

Coordinate System as shown in **ArcGIS**

Geographic Coordinate System Properties

General

Name: PMRail GRS80

Datum

Name: D_GRS_1980

Spheroid

Name: GRS_1980

Semimajor Axis: 6378137

☒ Semiminor Axis: 6356752.3141403561

☐ Inverse Flattening: 298.25722210100002

Angular Unit

Name: Degree

Radians per unit: 0.017453292519943295

Prime Meridian

Name: Greenwich

Longitude: 0° 0' 0"

Projected Coordinate System Properties

General

Name: PortMac TM LDF

Projection

Name: Transverse_Mercator

Parameter	Value
False_Easting	100000.00000000000000000000
False_Northing	500000.00000000000000000000
Central_Meridian	-150.00000000000000000000
Scale_Factor	1.000003999999999999999999
Latitude_Of_Origin	60.999999999999999999999999

Linear Unit

Name: Foot_US

Meters per unit: 0.304800609601219

Geographic Coordinate System

Name: PMRail GRS80
Angular Unit: Degree (0.017453292519943295)
Prime Meridian: Greenwich (0.000000000000000000)
Datum: D_GRS_1980
Spheroid: GRS_1980
Semimajor Axis: 6378137.000000000000000000

Select...
New...
Modify...

Note the displayed rounding differences on scale and latitude – this appears to be an ESRI issue and did not impact the intended use. Scale factor should display **1.000004** - exact. Latitude should display 61.0000 – exact.

Reprojection Verification In Leica Geomatics Office – LGO is BASELINE

Point Properties

General | Stochastics | Reliability | Thematical Data | Mean

Point Id: 1 ☒ Activated

Point Class: Control

Point Subclass: Fixed in Position and Height

Coordinate Type: Geodetic ☒ WGS84 ☐ Local

Coordinate Format: Latitude, Longitude, Height

Height Mode: ☒ Ellipsoidal ☐ Orthometric

Latitude: 61° 16' 41.79417" N Standard deviation: 0.0041 fts

Longitude: 149° 56' 20.27788" W Standard deviation: 0.0029 fts

Height: 332.3647 fts Standard deviation: 0.0086 fts

OK Cancel Apply

Point Properties

General | Stochastics | Reliability | Thematical Data | Mean

Point Id: 1 ☒ Activated

Point Class: Control

Point Subclass: Fixed in Position and Height

Coordinate Type: Grid ☐ WGS84 ☒ Local

Coordinate Format: Northing, Easting, Height

Height Mode: ☐ Ellipsoidal ☒ Orthometric

Northing: 601739.8264 fts Standard deviation: 0.0041 fts

Easting: 110739.727 fts Standard deviation: 0.0029 fts

Height: 332.365 fts Standard deviation: 0.0086 fts

OK Cancel Apply

In AutoCAD

Geodetic Calculator

Zone Description: Port Mac Rail Ext GRS80 NAD83 TM US Survey Foot

Point #:	
Latitude (DMS):	61.1641794170
Longitude (DMS):	-149.5620277880
Grid Northing:	601739.8260 (ft)
Grid Easting:	110739.7270 (ft)
Local Northing:	0.0000 (ft)
Local Easting:	0.0000 (ft)
Local Elevation:	0.0000 (ft)
Scale Factor:	1.000004131230
Convergence:	0.031268841100

* Sea level corrections WILL NOT be applied to Local Coordinates.

* Grid scale factor WILL NOT be applied to Local Coordinates.

Select Set Point

OK Cancel Help

In ArcGIS

