DOT&PF Southcoast Region
MAP No. 92337 – Section 4407 Easements
Project No. Z676360000 / R&M 2386.02

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July 15, 2016

Introduction:

In 2006, the Alaska Department of Transportation and Public Facilities (DOT&PF), the Department of Natural Resources (DNR) and the United States Department of Agriculture, Forest Service, Alaska Region (Forest Service) executed a Memorandum of Understanding[1] (MOU). The MOU intended to establish a process for an exchange of reciprocal rights-of-way and easements throughout Southeast Alaska over lands managed by the Forest Service or adjoining tidelands owned by the State of Alaska. The purpose of the MOU was to implement Section 4407 of the 2005 Federal Highway bill known as *SAFETEA-LU*[2]. The objective of this section was to authorize the exchange of rights-of-way and easements for Log Transfer Facilities and Marine Access Points located on State owned tidelands for linear Transportation and Utility Corridor (TUC) rights-of-way and easements located on Forest Service lands. Section 4407[3] incorporated by reference *Map No. 92337* that identified the easements to be exchanged using symbols for the Log Transfer Facilities and Marine Access Points and a yellow line to identify the general location of the Transportation and Utility Corridors.

The Forest Service asserts in a document titled *Map No. 92337 talking points*[4] that the yellow line as shown on *Map No. 92237* represents the absolute fixed legal position of the proposed TUC road centerline as intended by Congress without regard to the inherent inaccuracies of such a small-scale map. This assertion ignores commonly accepted engineering practice that may commence with a preliminary line on a topographic map as an initial route location followed by surveys, hydrographic, geotechnical and environmental investigations that result in centerline adjustments necessary for a practical and economic route location.

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[1] *Memorandum of Understanding between United States of America Through the U.S. Department of Agriculture, Forest Service, Alaska Region and the State of Alaska, Through the Department of Natural Resources and the Department of Transportation and Public Facilities*, FS Agreement No. 06MU-11100100-151, State of Alaska Agreement No. ADL 107516, dated September 29, 2006.

[2] *Public Law 109-59 Safe, Accountable, Flexible, Efficient Transportation Equity Act*, August 10, 2005.

[3] Sec. 4407, Rights-of-Way; "Notwithstanding any other provision of law, the reciprocal rights-of-way and easements identified on the map numbered 92337 and dated June 15, 2005, are enacted into law."

[4] Note: The copy of this document provided by DOT&PF is unattributed, undated, and unsigned.

My conclusion is that the Forest Service assertion is in error and has completely missed the intent of Congress by interpreting the yellow TUC centerline on *Map No. 92337* as geographically fixed and not subject to adjustments based on engineering judgment as a part of basic route location practice. The evidence and standards supporting this conclusion are discussed in the following sections titled Mapping Standards, Legislative Mapping and Route Location.

Public Law 109-59 Sec. 4407: Map No. 92337

The materials provided by DOT&PF for this review do not provide a clear history of the communication between the State of Alaska and the Forest Service that led to the selection of the specific sites desired by the Forest Service or the alignment of the transportation corridors desired by the State. I reviewed a PDF copy of *Map No. 92337* dated June 15, 2005 as cited in Section 4407 of SAFETEA-LU Highway bill and a PDF copy of an apparent preliminary version

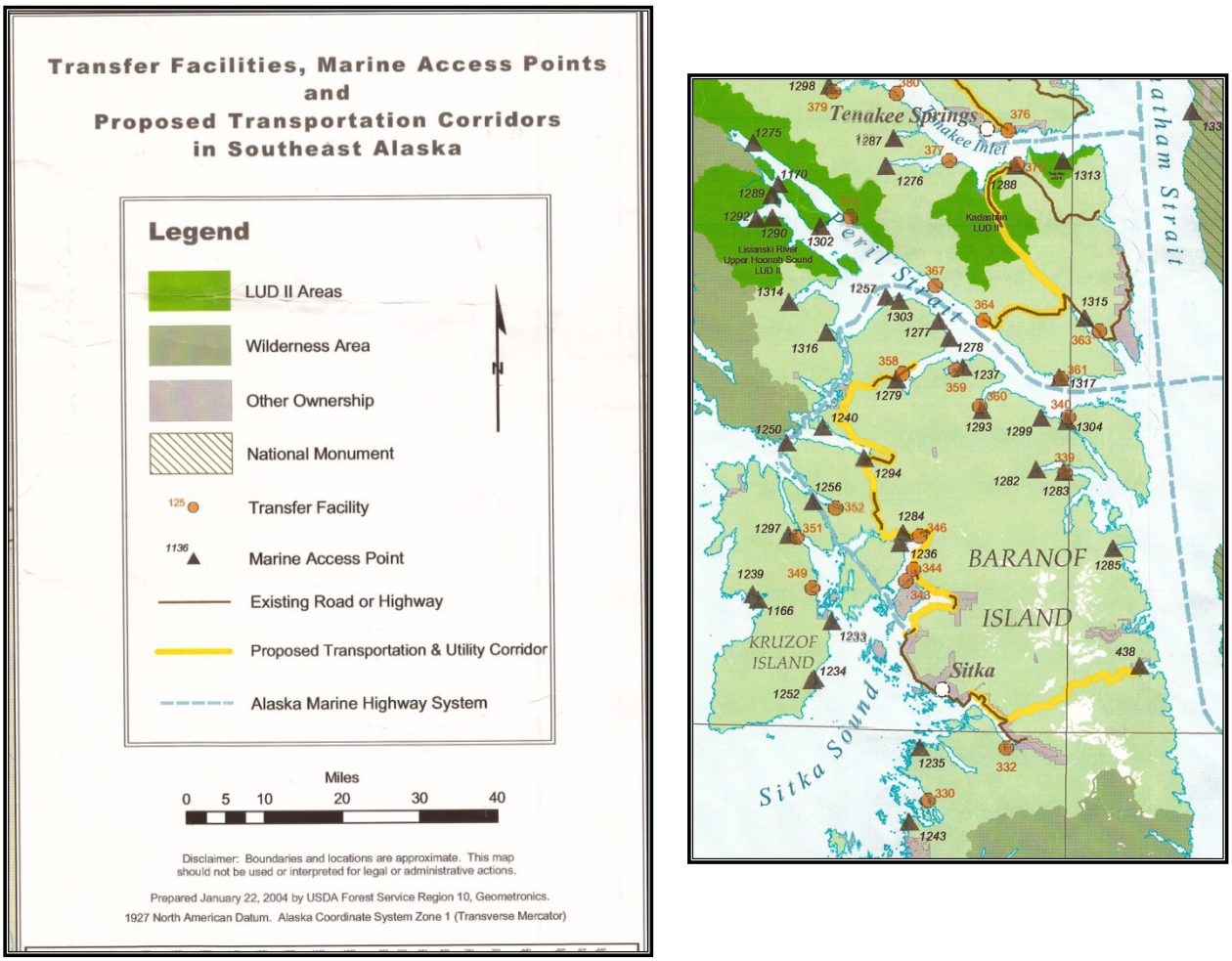

Figure 1 – January 22, 2004 Preliminary Reciprocal Easement Map

of the map dated January 22, 2004. The preliminary version is a scanned raster[5] image titled *Transfer Facilities, Marine Access Points and Proposed Transportation Corridors in Southeast Alaska.* The title block and a representative portion of the map are shown in Figure 1. Noteworthy items for this version of the map include:

- Log Transfer Facilities and Marine Access Points are noted by symbol and number.
- Proposed Transportation & Utility Corridors are identified by a heavy yellow line.
- Existing roads are identified with a brown line.
- The map was prepared by USDA Forest Service Region 10, Geometronics.
- A disclaimer states: "Boundaries and locations are approximate. This map should not be used or interpreted for legal or administrative actions."
- The map claims to be based on the 1927 North American Datum, Alaska Coordinate System Zone 1 (Transverse Mercator)[6]

Map No. 92337 dated June 15, 2005 was also provided in a PDF format although it was presented in a vector[7] format rather than raster. The image is crisper although it contains many of the same features as the preliminary map. Noteworthy items for this version of the map include:

- Existing roads are identified with a red line.
- The title block contains no reference to the agency who prepared the map.
- There is no disclaimer.
- The map is signed by then DOT&PF Commissioner Mike Barton as "adopted".
- Above the map title is the label "Map No. 92337".
- Below the map title are the seals and labels identifying the State of Alaska and DOT&PF.
- The datum continues to list Zone 1 as a "Transverse Mercator" as opposed to an "Oblique Mercator" projection.

In Figures 1 & 2 for both versions I have included a portion of the map image in approximately the same location in order to compare the graphics detail and quality.

[5] A raster graphic consists of a matrix of pixels or dots organized into grid. Raster images include digital aerial photographs and scanned maps.

[6] According to the A.S. 38.20.060 definition of Alaska State Plane Zones, Zone 1 is based on an "oblique Mercator projection" as opposed to a "Transverse Mercator" projection.

[7] A vector format for an image or map consists of points, lines and curves that are scalable. As a result they are easily edited, have a smaller file size and are of high graphic quality.

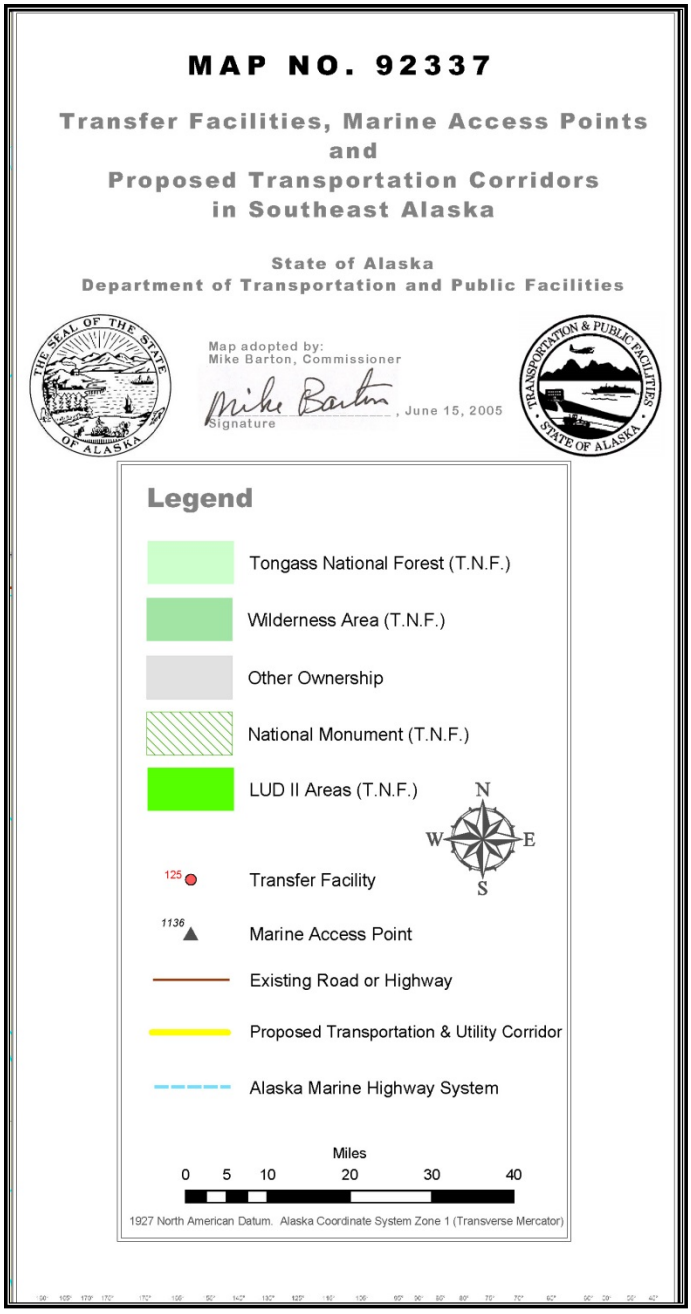

Figure 2 – June 15, 2005 – Map No. 92337

In order to implement Section 4407 of the reciprocal easement legislation, the Forest Service, DNR and DOT&PF entered into the 2006 MOU (see fn1) that outlined the process by which the easements would be exchanged.

MOU Section D. titled "The United States Shall:" specified the nature of and method by which the transportation corridor easements would be conveyed to the State of Alaska. With regard to positioning for the corridor easements, paragraph D. 1. continued with the following:

> The location of the rights-of-way will be as set forth in the Map … Attachment B shall identify the section, township, range and meridian designation of the servient estate, and will include a starting point, ending point, and approximate width and alignment (emphasis added) of each right-of-way corridor. The location of the right-of-way will be further detailed by a survey diagram or diagrams at times and places mutually agreed by the parties and such survey diagram will be prepared during the course of activities described above, but prior to construction.

"Attachment B" identified in paragraph D.1. is a prototype easement document to be used for the preliminary definition and investigation of the transportation corridors according to the following language:

> NOW THEREFORE, Grantor, as authorized by law, does hereby grant and convey to Grantee … a right-of-way easement of approximately 300 feet in width, … for highway and utility planning purposes, including the right to conduct engineering and all other activities necessary or incident to highway and utility planning, design and environmental review processes, along, over and across the following described lands … (emphasis added)
>
> 6. Grantee may conduct such necessary surveys and investigations as are necessary for the preparation of plans and drawings for future construction or placement of highway and/or utility developments within the land area described herein, including brushing for ground surveys, geotechnical investigations to determine foundation conditions, and other similar actions.

MOU Section D.2. describes a renewable 55-year easement referenced as "Attachment C" that would be issued prior to construction upon submittal by the State of a *survey diagram* showing the approximate location of the proposed improvements as approved by the Forest Service:

> The easement shall be for construction, reconstruction, operation and maintenance of roads, utilities, and other linear transportation and utility purposes.

"Attachment C" identified in paragraph D.2. is a prototype easement document to be executed upon completion of preliminary engineering and surveying activities and issued prior to construction.

> 2. The ROW Easement shall be 300' in width of the construction limits, whichever is greater.
>
> 8. If the highway project is federally funded, the design and construction of highway project(s) situated within this right-of-way shall be in accordance with the provisions of Title 23, United States Code—Highways, and amendments; the Regulations for the Administration of Federal Aid for Highways, in effect at the time of construction; … If the highway project is not federally funded and the intended traffic include general public access and use, the highway construction shall meet either the current policy and standards of *The American Association of State Highway Officials (AASHTO)* ... The parties may agree to apply relevant portions of the Grantee's Preconstruction Manual where appropriate or needed.

The MOU D.1./D.2. easement process along with the prototype documents referred to as Attachments B and C represent a two-step process that first permits temporary access to Forest Service lands to carry out surveys, environmental and geotechnical investigations along an "approximate width and alignment" in support of the roadway design. This data will be used in the design process to generate alignments, grade lines, typical sections and other roadway features that are compliant with the design standards. Once a design is complete, and the construction footprint can be estimated, the right-of-way plans/plat (survey diagram) will be prepared to define a ROW/easement corridor that will accommodate construction and future maintenance activities.

This is a common road design and route location process where a permit to enter lands may be used to gather data for the design process and the permanent ROW is executed when the alignment has been adjusted and refined and the ROW width requirements are known. In Alaska, the first easement (D.1.) is often unnecessary due to the State's statutory authority to enter onto private property to perform surveys and examinations as a part of a public project[8]. Depending on the level of impact of the surveys or geotechnical investigations, a temporary use permit or right of entry may be required for certain state and federal lands and other properties. The convention is that the alignment for the preliminary entry is approximate and will be refined to according to design, environmental and geotechnical constraints prior to execution of the final ROW document. According to the language in Attachment C, paragraph 8, the design elements shall comply either with federal, AASHTO or state standards.

At some point there was concern as to whether the Section 4407 (fn3) language specifying that the reciprocal rights-of-way and easements were "hereby enacted into law" was

[8] A.S. 09.55.280 Entry upon land. In all cases where land is required for public use, the state, the public entity, or persons having the authority to condemn, or its agents in charge of the use may enter upon the land and make examination, surveys, and maps and locate the boundaries;

sufficient to carry out the Congressional intent to create these real property interests. To cure this perception, Congress provided a technical amendment to Section 4407 that replaced the words "hereby enacted into law" with the word "granted". This was accomplished under Section 1146(c) of Public Law 114-94[9].

An explanation of the need for the technical correction and the Congressional intent can be found in the July 15, 2015 report from the Committee on Environment and Public Works[10].

> SAFETEA-LU established reciprocal easements in section 4407 between the United States Forest Service and the State of Alaska. The technical amendment of this section cures a perceived defect and now will allow the exchange of all remaining reciprocal easements to continue. As soon as possible, the Committee intends the Secretary of Agriculture (Secretary) to prepare and deliver to the State of Alaska an easement for the construction and operation of each highway located in a transportation and utility corridor identified on Map No. 92337 where the State of Alaska has already secured all necessary Federal and State permits for the construction of each highway facility. The Secretary of Agriculture is encouraged to participate as a cooperating agency in the environmental analysis and permitting of the remaining State highways to be located in Map No. 92337's transportation and utility corridors linking the communities of Southeast Alaska. The Committee intends that the Secretary of Agriculture will not withhold or deny the issuance of an easement for a proposed transportation or utility project that otherwise has all necessary construction permits and authorizations from other State and Federal agencies.

With this clarification, there should have been no remaining impediment to carrying out the easement exchange as intended by Congress.

Mapping Standards

The paper titled *Map No. 92337 talking points* has been attributed to the Forest Service. (fn4) The paper notes that *Map No. 92337* contains no statement or meta-data suggesting that it is compliant with the *National Map Accuracy Standards*[11] (NMAS) or any other standard. The paper then goes on to discuss how, in the absence of an accuracy statement, one could test well-defined points on the map against higher standard mapping or survey data to determine if a map meets NMAS. The talking points paper says that with *Map No. 92337* published at an approximate scale of 1:754,286 (1" = 62,857 feet or 1" = 12 miles), 90% of the well-defined

[9] P.L. 114-94, December 4, 2015 "Fixing America's Surface Transportation Act (FAST Act)

[10] Report 114-80 (to accompany Senate Bill 1647) from the Committee on Environment and Public Works, July 15, 2015, Title IV Section 4001 – Technical Corrections, page 23 & 24.

[11] NMAS issued by U.S. Bureau of the Budget June, 10, 1941, Revised June 17, 1947

points have to be within 1,257 feet of the same point on the higher standard mapping. Using these techniques, the paper suggests that the map accuracy can be improved to the extent that coordinate values for the "yellow" transportation corridor lines can be determined and precisely located on the ground using GPS[12]. The paper ends with a summary that in part states: "Congress chose to use the yellow line on the map regardless of any positional inaccuracy that may inherently be contained in the map … We can georeferenced (sic) the map to a highly accurate base map that will preserve the relationship of map features while establishing a centerline location that can be transferred to the ground."

Map No. 92337 would not be considered a topographic map as it does not use contour lines to show differences in elevation. As a result it is not very useful for road engineering purposes which would include determinations of grades, cross slopes and material quantities. *Map No. 92237* would be classified as a small-scale[13] reference or general-purpose map. A general-purpose map would show both natural and human made features such as coastlines, lakes, rivers, roads, settlements and others. The emphasis in general-purpose maps is on location and the geographic relationships between features. The *NMAS* testing process requires the identification and accurate location by survey of a number of "well-defined" points. The *NMAS* states:

> These limits of accuracy shall apply in all cases to positions of well-defined points only. Well-defined points are those that are easily visible or recoverable on the ground, such as the following: monuments or markers, such as bench marks, property boundary monuments; intersections of roads, railroads, etc.; corners of large buildings or structures (or center points of small buildings); etc. In general what is well defined will be determined by what is plottable on the scale of the map within 1/100 inch.

Given the small scale of *Map No. 92237* and the ambiguous nature of its production and standards, I do not believe that there exist points on this map that can be considered "well-defined" for the purpose of *NMAS* map testing and validation. While *Map No. 92337* does not contain an NMAS compliance statement, in the context of assessing its potential to have its accuracy improved and validated such that it can be used for engineering purposes, NMAS standards do apply. In addition, to suggest that *Map No. 92337* can be enhanced and made sufficiently accurate to locate the TUS centerlines on the ground also suggests that the ROW or

[12] Global Positioning System (GPS): a space-based navigation system that provides location in all weather conditions anywhere near or on the earth where there is an unobstructed line of sight to four or more GPS satellites.

[13] USGS Fact Sheet 015-02, February 2002, *Map Scales*. This flyer considers small-scale maps to be at a scale of 1:250,000 and smaller. Generally these maps show large areas on single map sheets but details are limited to major features.

study corridor was intended by Congress to be exceptionally wide based on the scaled width of the "yellow" corridor lines at map scale. That conclusion along with the suggestion that the *Map No. 92337* TUS centerlines can be accurately located on the ground constitutes an extraction of information and intent that does not exist in reality.

All of the discussion presented by the Forest Service "talking points" regarding mapping standards constitutes a red herring. The issue is not the accuracy of the map associated with the reciprocal easement legislation but the intent and purpose of the map. How were those "yellow" lines defined and placed on the map? Alignments for transportation systems are not designed or preliminarily located using 1:750,000 land status planimetric mapping. The map contains insufficient detail to identify critical route location issues such as grades, wetlands, river crossings and cross slopes. The terms *precisely* (as in *precision)* and *accuracy* are used throughout the "talking points" paper. Accuracy vs. precision is a basic concept for surveyors, mappers and scientists. Precision relates to the refinement of the measurement or how closely repeated measurements come to duplicating measured values. Accuracy on the other hand refers to how closely a measurement comes to measuring the "true value".[14] The paper asserts that the coordinate positions extracted from the "accuracy tested" *Map No. 92337* can be "precisely" located on the ground using GPS. I agree that a coordinate value can be extracted from the map can be repeatedly (or precisely) located on the ground using GPS within a few centimeters. I disagree that this "precisely" located point is an "accurate" representation of the true point as intended by the authors of *Map No. 92337* and the reciprocal easement legislation.

What is the purpose of *Map No. 92337* and how was it prepared? It is reasonable to conclude that the purpose of the map was to provide a generalized or schematic representation of the geographic locations for the reciprocal easements including the transportation corridors. As stated in congressional Report 114-80 (fn 10), Congress intended that *Map No. 92337* identify transportation and utility corridors that would link the communities of Southeast Alaska. As a "general-purpose" reference, *Map No. 92337* accomplishes that objective. Can a 1:750,000 scale map provide an accurate location of the transportation corridor centerlines such that the positions as represented by the "yellow" line on the map can be considered absolute and indicative of the true legislative intent? I believe that such an assertion would be unreasonable. A 1:750,000 scale map would be an inappropriate tool to use for such a purpose due to its small scale and *map generalization*. A short definition of *map generalization* in cartography is "the selection and simplified representation of detail appropriate to the scale

[14] See http://celebrating200years.noaa.gov/magazine/tct/tct_side1.html *Accuracy Versus Precision*

and/or the purpose of the map.[15] A more detailed description of generalization can be found in a mapping text[16] by professor of geography, Mark Monmonier as follows:

> Clarity demands geometric generalization because map symbols usually occupy proportionately more space on the map than the features they represent occupy on the ground.
>
> …cartographers recognize the five fundamental processes of geometric line generalization…*selection* is a positive term that implies the suppression, or nonselection, of most features … *Simplification*, which reduced detail and angularity by eliminating points from the list, … *Displacement* avoids graphic interference by shifting apart features that otherwise would overlap … *Smoothing*, which also diminishes detail and angularity … *Enhancement* adds detail to give map symbols a more realistic appearance.
>
> The National Map Accuracy Standards tolerate geometric generalization. Checkers test only "well-defined points" that are readily identified on the ground or on aerial photographs, easily plotted on a map, and conveniently checked for horizontal accuracy;

Professor Monmonier's discussion suggests that a the "yellow" line on a small-scale map such as *Map No. 92337* could not provide an accurate representation of route centerlines due to the five fundamental processes of geometric line generalization. The routes as depicted on *Map No. 92337* are clear as to their approximate locations but cannot be held as absolute positions due to the *generalizations* required to prepare such maps. In the same sense, the symbols placed on *Map No. 92337* to represent the Log Transfer Facilities and Marine Access Points are subject to generalization in order to ensure that their geographic relationships are clear. As a result, the symbols overlap each other, are offset from their true positions and are shown at an excessive size due to the map scale. For example, at map scale the symbols measure over a mile in diameter or along a leg of a triangular symbol. Sites that are intended to be located in the tidelands are shown to occupy the uplands. These mapping techniques are used to more clearly represent features on a general-purpose map. It is also clear that a generalized map that proposes to reflect the preliminary or approximate transportation corridors could still meet National Map Accuracy Standards.

United States Geological Survey (USGS) 1:63,360 scale (1"=1 mile) quadrangle mapping has been available through most of Alaska including Southeast since the late 1940's and early

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[15] *What is Generalisation?* International Cartographic Association *(ICA 1967)* http://www.gitta.info/Generalisati/en/html/GenConcepts_learningObject1.html

[16] *How to Lie with Maps*, Mark Monmonier, University of Chicago Press, 1991

1950's. Unless newer and more accurate mapping were available, these maps would commonly be used in the "office" phase of preliminary route location. Given the availability of the USGS mapping, it is reasonable to believe that route selection for the preliminary *Map No. 92337* transportation corridors were based on these topographic maps. To test this theory I imported ESRI Shape[17] files for the *Map No. 92337* transportation corridors[18] into Google Earth. In Google Earth, the transportation corridor alignments can be viewed either as an overlay onto aerial/satellite photography or digital USGS quadrangle maps.

For a test case, I selected the Sitka Baranof corridor that runs from the end of Sawmill Creek road near the northeast corner of Section 3, Township 55 South, Range 64 East, Copper River Meridian; then southeasterly to Bear Cove; then easterly across Baranof Island to a point near the village of Baranof in Section 19, T. 55 S., R. 67 E., C.R.M. Viewing the over-lays it was apparent that the alignment was intended to run along the coast line and then up the sides of the river valleys to avoid wetlands. As the shapefile definition, presumably extracted from the *Map No. 92337* vector PDF, is being overlain onto a 1" = 1 mile map that is at a 12 times larger scale, the alignment appears crude and does not match the sinuosity of the coastline or topographic contours very well. Occasionally the alignment appears to cross into the coastal waters and lakes and poorly matches the alignment of existing roads where the expectation would be to follow and incorporate them where possible. It is clear that the alignment represents a first cut "office" phase reconnaissance level location that likely made more sense when it was initially drafted to follow key topographic features on the USGS 1" to 1 mile quad maps. In the western half of the corridor, there is an approximate 1 ¼ mile straight segment running east-west through Section 10 and 11 of T. 56 S., R. 65 E., C.R.M. This is where the transportation corridor passes over a peak to the south of Mt. Bassie. In the following Figure 3[19], the contours on the USGS quad map indicate that at its steepest, the existing ground profile approaches an 80% slope or a vertical drop of 80-feet for every horizontal 100-feet. This feature and the steepness of the slopes cannot be discerned from *Map No. 92337* when it is enlarged to an approximate similar scale. (See lower half of Figure 3) It is clear that the

[17] The shapefile format is a digital vector format for storing geometric location and associated attribute information. The shapefile format was introduced with ArcView GIS in the early 1990's. ArcGIS is a product of ESRI, Environmental Systems Research Institute, an international supplier of Geographic Information System (GIS) software.

[18] I found no documented provenance for the specific shapefiles, however, communication with DOT&PF indicates they were produced by and received from the Forest Service.

[19] This 1:63,360 image was extracted from the USGS Quad Sitka (A-4), Alaska dated 1951, minor revisions 1969 and based on 1948 aerial photography. The location of the "yellow" line transportation corridor was drawn onto this image relative to the shapefile location as viewed in Google Earth. The second image in Figure 3 is an enlargement of the tunnel site area taken directly from the Map No. 92337 vector PDF map provided by the Forest Service.

mountain was considered and could only be identified using a map of greater detail than can be provided on *Map No. 92337*.

The *impossible* alignment over top of Baranof Island was addressed in the MOU D.1. easement document[20] recorded in 2010. The 1 ¼ mile segment is labeled as a "proposed tunnel".

While it is apparent that the USGS Quad maps were used to select preliminary alignments for the transportation corridors, they have limitations that would make them unsuitable to be used as the sole basis for a final design. A USGS Fact Sheet titled *Map Accuracy Standards*[21] states the following:

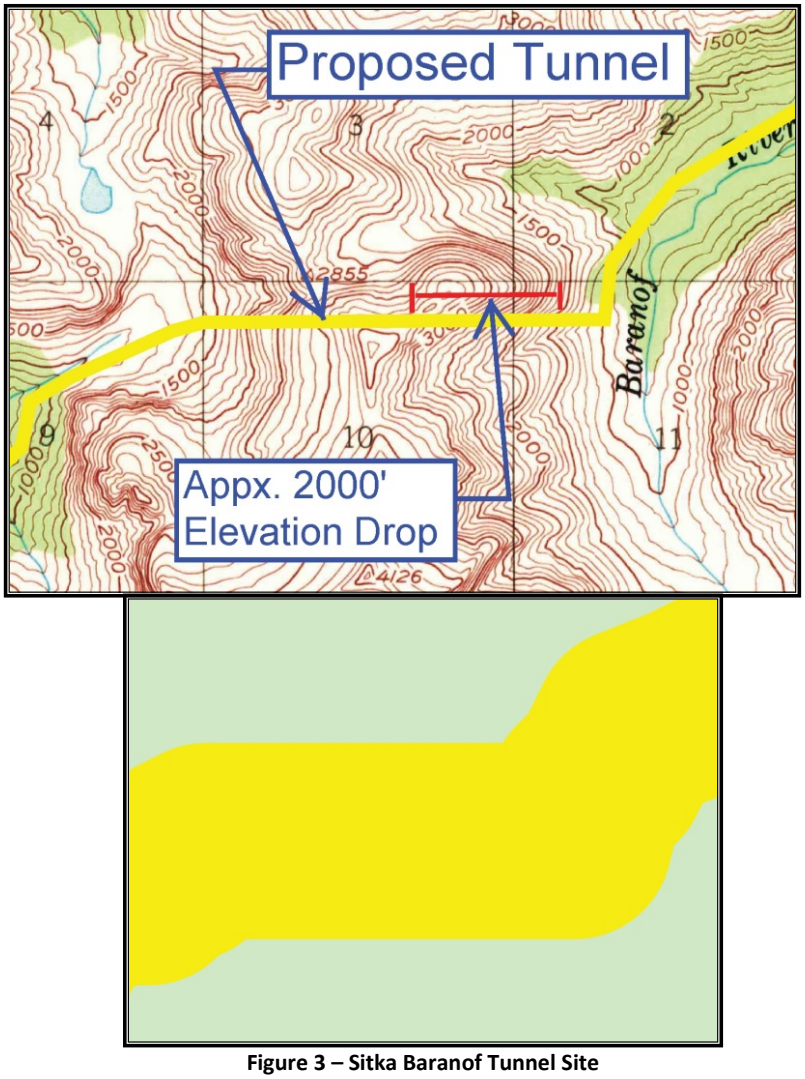

Figure 3 – Sitka Baranof Tunnel Site

[20] Document No. 2010-001299-0 recorded on October 13, 2010 in the Sitka Recording District.
[21] *Map Accuracy Standards* - U.S. Geological Survey Fact Sheet 171-99, November 1999.

> An important aim of its accuracy control program is to meet the U. S. National Map Accuracy Standards.
>
> Dependability is vital, for example, to engineers, highway officials, and land-use planners who use USGS topographic maps as basic planning tools. (emphasis added)
>
> In 1958, the USGS began systematically testing the accuracy of its maps. In testing a map, the USGS experts select 20 or more well-defined points; … Field survey methods are the only tests accepted for official accuracy testing. Positions must be obtained by surveys of a higher accuracy … If the map is accurate within the tolerances of the U.S. National Map Accuracy Standards, it is certified and published with the statement that it complies with those standards.

The USGS map used in Figure 3 was published before the 1958 date when they began to test the accuracy of the maps and it does not contain a certificate or statement that it meets *National Map Accuracy Standards*. While it may have been the best available tool to locate a preliminary alignment, the inherent inaccuracies particularly relating to contours, slopes and grades require that an initial alignment be refined using field surveys, updated and controlled aerial photography or other advanced mapping techniques.

The previously cited USGS Fact Sheet relates to the USGS nationwide mapping program. In 1973, USGS sent a letter[22] discussing the accuracy of USGS maps in Alaska to the Alaska Commissioner of DNR.

> We know of only one Alaskan map that has been formally tested for horizontal accuracy … Therefore, we have to estimate the accuracy of most classes of Alaska maps by indirect means.
>
> The new 1:63,360-scale maps.—These maps are controlled by new third-order or better horizontal control and scaled by semi-analytical methods. The accuracy of these maps probably is close to National Map Accuracy Standards and we estimate that 90% of identifiable points should fall within 100 feet of true position.
>
> The old 1:63,360-scale maps. – These maps (mostly 1956 to 1963) were controlled by third-order surveys and scaled by long bar bridging or slotted templets. (sic) Recent surveys have found the planimetry to be in error by 50 to 400 feet. Assuming that the 400 foot error represents a three sigma value, we estimate that 90% of identifiable points should fall within 200 feet of true position.

[22] Letter from W.A. Radlinksi, Associate Director, USGS to Charles F. Herbert, Commissioner, Alaska Department of Natural Resources, dated May 9, 1973.

The letter suggests that the older Alaska USGS quad maps such as the ones that must have been used to select the *Map No. 92337* preliminary transportation corridors are potentially subject to greater errors than new USGS mapping and those falling under *National Map Accuracy Standards* as indicated in the USGS *Map Accuracy Standards* Fact Sheet. This provides stronger support for an assertion that these maps would not have been the basis for a final design alignment that resulted in the "yellow" line placement on *Map No. 92337*.

A recent 9th Circuit Court of Appeals case[23] addressed a dispute regarding a map prepared by the Bureau of Land Management and whether it was sufficiently accurate to locate a specific type of soils. The map contained a broad disclaimer:

> The Bureau of Land Management cannot assure the reliability or suitability of this information for a particular purpose. Original data was compiled from various sources. Spatial information may not meet National Map Accuracy Standards."

While the 2004 preliminary version of *Map No. 92337* did include a disclaimer, *Map No. 92337* itself does not contain a disclaimer, a reference to the *National Map Accuracy Standards* or any meta-data that would attest to its accuracy or source. A map without such a disclaimer is as suspect or more suspect than a map that outlines its deficiencies. In the BLM case, the court stated that "… all the other maps with the disclaimer are illustrative rather than depictions creating static, binding obligations on BLM."

Legislative Mapping

Land related legislation often requires associated mapping to provide a specific or general outline of the boundaries and areas subject to the law. A significant example for Alaska would be the *Alaska National Interest Lands Conservation Act*[24] (ANILCA). In 1980, Congress passed ANILCA establishing more than 100 million acres of federal land in Alaska as new or expanded conservation system units (CSUs)[25]. The ANILCA maps were crude, small-scale representations of the lands subject to the law:

> Maps Sec. 103(a) The boundary maps described in this Act shall be on file and available for public inspection … In the event of discrepancies between the acreages specified in this Act and those depicted on such maps, the maps shall be controlling, but the boundaries of areas added to the National Park, Wildlife Refuge and National Forest Systems shall, in coastal areas not extend seaward beyond the mean high tide line to include lands owned by the State of

[23] *Klamath-Siskiyou Wildlands Center v. Gerritsma*, February 29, 2016, Westlaw No. 775297
[24] Public Law 96-487, 94 Stat. 2371, December 2, 1980
[25] See Alaska DNR ANILCA Website: http://dnr.alaska.gov/commis/opmp/anilca/index.htm

> Alaska…Whenever possible boundaries shall follow hydrographic divides or embrace other topographic or natural features … Only those lands within the boundaries of any conservation system unit which are public lands (as such term is defined in this Act) shall be deemed to be included as a portion of such unit.

Unlike *Map No. 92337* that provides a general preliminary location to commence the survey and design for a transportation corridor, the ANILCA maps depict a general outline of geographic boundaries. For example, Section 202 of ANILCA addressed the *Glacier Bay National Monument* as follows:

> The following units of the National Park System are hereby expanded: (1) Glacier Bay National Monument, by the addition of an area containing approximately five hundred and twenty-three thousand acres of Federal land. Approximately fifty-seven thousand acres of additional public land is hereby established as Glacier Bay National Preserve, both as generally depicted (emphasis added) on map numbered GLBA-90,004, and dated October 1978;

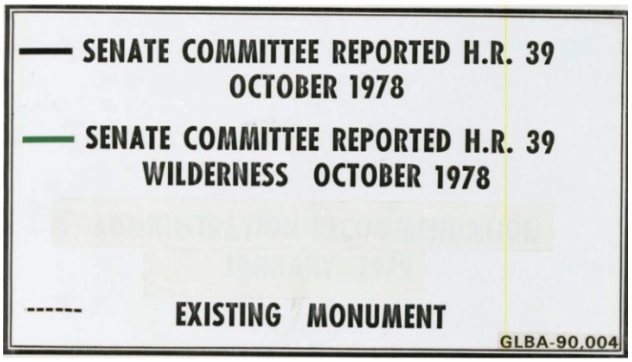

Figure 4 – ANILCA Glacier Bay Map Title Block

Figure 5 – ANILCA Legislative Mapping

In the Glacier Bay example, the official map[26] identifies the general location of the congressionally approved boundaries using wide tape over the 1:250,000 scale USGS Yakutat Quadrangle map. Had the map later been interpreted without the benefit of clarifying language in the ANILCA text, locating the absolute geographic boundaries of the preserve and monument based on tape lines would have conflicted with valid existing rights. Fortunately, the ANILCA text prevents the assertion of the CSU boundaries out into the State owned tidelands, controls boundaries according to hydrographic divides and other topographic features and ensures that the boundaries are maintained within the limits of existing federal lands.

Given the ANILCA language establishing intent and the fact that the ANILCA boundaries represent geographic areas as opposed to approximate corridors for upon which to commence an engineering design of a roadway, the ANILCA maps, although crude, adequately served their purpose.

According to the text in the title block for the preliminary version of *Map No. 92337* dated January 22, 2004 (See Figure 1), *Map No. 92337* was prepared by the Forest Service. The Forest Service manual contains an interim policy[27] regarding the production of legislative maps that has an effective date of January 4, 2011 and an expiration date of July 4, 2012. It is unclear whether the Forest Service had such a policy prior to this date or continues to have a similar policy. Key elements of the directive are as follows:

> 1517.02 – Objectives – Prepare and distribute timely and authoritative maps or other projections of National Forest System land ownership, rights, and long-term land uses through standardized and recognizable maps to support congressional consideration of legislation or to answer inquiries of the Congress or other executive branch agencies.
>
> 1517.04 – Responsibility – Prior to the passage of legislation by the Congress, ensure that the accompanying Legislative Map is reviewed by a state-licensed professional land surveyor to verify that proposed boundaries can be legally described and marked as necessary.

Had this policy been in place prior to the production of *Map No. 92337*, it is unlikely that a licensed professional land surveyor would reach the conclusion that the map provided a valid tool with which to locate a real property interest such as a road right-of-way for a facility that not yet been designed.

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[26] See DNR site for scanned copies of original maps used by Congress and the ANILCA legislation: ANILCA Boundary Maps - http://dnr.alaska.gov/mlw/title/anilca/index.cfm

[27] FSM 1500 – External Relations Chapter 1510 – Legislative Affairs; Interim Directive No. 1510-2011-1; page 3 of 9, Section 1517 Legislative Maps.

Route Location

One purpose of this report is to illustrate the relationship between topographic mapping and route location. The design of roads clearly falls under the "practice of engineering" as defined in Alaska Statute 08.48.341 Definitions. The author of this report is a Professional Land Surveyor licensed to practice in the State of Alaska and is not a licensed engineer. However, two of the key elements of route design, surveying and mapping, do fall under the statutory definition of the "practice of land surveying"[28]. In the context of land planning and subdivisions, work related to "alignment and grades for streets" also falls within the definition of "land surveying". While the performance of "engineering surveys" are permitted under the "practice of engineering", the route survey for a road generally will include the location of a real property interest in the form of a right-of-way and will typically be under the responsible charge of the professional land surveyor. The following discussion on route location intends to reflect the iterative process used by professional surveyors and engineers to select a road alignment and why an absolute line on a map centerline location would be incompatible with conventional route location practice.

In the previous discussion on Mapping Standards, USGS topographic maps are identified as a significant tool to be used in the "office" phase of preliminary route location. This basic function of topographic mapping is explained in USGS publications[29]:

> The planner of major highways knows that good topographic maps provide ready-made field reconnaissance. If the maps are available, he studies them carefully before selecting a preliminary route (emphasis added) for a new highway. A topographic map will tell him about the features of the land, approximate amount of cut and fill, drainage, where bridges may be needed, degree of economic development of the area, and other useful information such as the location of gravel pits. Topographic maps are also used in planning minor roads, such as logging, ranch, access, and national forest roads.

Forest Service engineering manuals also provide guidance regarding the location and design of roadways as follows[30]:

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[28] A.S. 08.48.341 Definitions (13) *"practice of land surveying" means the teaching of land surveying courses at an institution of higher learning, or any service or work the adequate performance of which involves the application of special knowledge of the principles of mathematics, the related physical and applied sciences, and the relevant requirements of law for adequate evidence of the act of measuring and locating land, geodetic and cadastral surveys for the location and monumentation of property boundaries, for the platting and planning of land and subdivisions of land, including the topography, alignment, and grades for streets, and for the preparation and perpetuation of maps, record plats, field notes records and property descriptions that represent these surveys.*

[29] *Topographic Maps: Tools for Planning*, USGS Publication - U.S. Government Printing Office: 1980-311-348/53; https://pubs.er.usgs.gov/publication/70039402

20.2 – Objective 1. To identify, on the ground, the location of a road that best satisfies the design criteria and Road Management Objectives (RMOs).

20.5 – Definitions Corridor. A strip of land within which a road can be located. A corridor can vary from several hundred feet in width to a tightly constrained centerline marked on the ground.

22 – Field Location 1. Choose the correct location. Choosing the correct location is the most important part of road construction or reconstruction. Proper field location is particularly critical for low standard roads; because the field location often becomes the final horizontal and vertical alignments. The field located alignments also determine drainage patterns that may contribute to long-term maintenance needs, disruption of natural hydrologic processes, and water quality impacts. A properly located road will result in lower costs, fewer maintenance problems, and reduced environmental impacts.

23.1 – Office Location Techniques – To use field time most efficiently make a thorough office study before going into the field. The corridors identified in transportation analysis can be refined and alternative road locations studied by use of Geographic Information System (GIS), maps, stereoscopic resource photography, and digital terrain modeling. Consider the use of appropriate remote sensing techniques. Digital terrain modeling has the advantage of not only identifying alternative locations but also providing preliminary design quantities for use in calculating preliminary cost estimates.

The few paragraphs cited from the Forest Service's own manual on road design indicates that route location techniques and criteria are no mystery to their engineering and surveying staff. Additional examples can be drawn from the Forest Service's Field Guide for *Low-Volume Roads Engineering*[31] and those of other agencies.

There are a variety of standard route surveying and design texts that have provided engineering professionals guidance on practical methods and procedures for location of transportation corridors over the past many decades.

The often referenced text *Route Surveying and Design*[32] discusses basic principles of route location relevant to this review:

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[30] Forest Service Handbook – FSH 7709.56 – Road Preconstruction Handbook – Chapter 20 Road Location – Am. 7709.56-2011-1, Effective Date July 13, 2011.

[31] See Best Management Practices for Low-Volume Roads Engineering, Chapter 4 http://www.blm.gov/bmp/field%20guide.htm

[32] Route Surveying and Design 4th Ed. Carl F. Meyer, 1969

> 1-10 Purposes of Preliminary Surveys – A preliminary survey follows the general route recommended in the reconnaissance report. The most important purpose of such a survey is to obtain data for plotting an accurate map of a strip of territory along one or more promising routes. This map serves as the basis for projecting the final alignment and profile, at least tentatively.
>
> 1-11 Proper Use of Topography … A contour map, no matter how accurate it is, cannot impress upon the mind as forcibly as field examination such details as the true significance of length and depth of cuts and fills; nature of the materials and foundations; susceptibility to slides, snow drifting, and other maintenance difficulties; or the aesthetic values of a projected location. At best, the map facilitates making what might be termed a "semifinal location," which is to be further revised in minor details during the location survey.

Geometric Design Projects for Highways[33], published by the American Society of Civil Engineers also provides an outline of using USGS topographic maps to establish a preliminary route alignment and then applying engineering principles to refining it as necessary:

> An inspection of the maps should include the following steps:
>
> 1. Identify unsuitable ground conditions such as wetlands, rock outcrops, areas subject to flash flooding or avalanche, and other features of and obviously difficult terrain for highway construction.
> 2. Examine the contour lines to obtain an initial estimate of the gradients that exist on undulating or mountainous parts of the potential route.
> 3. Define streams, rivers, ravines, or other topographic features that indicate the possible need for bridges or other extensive ancillary works to the highway itself.
> 4. List typical types of subsurface and soil conditions that may be expected …
>
> Establishing an Initial Alignment: Development of the alignment is a trial and error process involving defining a trial alignment, then checking to see if it complies with the horizontal and vertical controls, then modifying it in successive iterations until all the controls are complied with.

The process includes selecting the shortest route that will meet the horizontal design controls and examining the contours along the initial alignment for excessive grades. The topographic map contours are then used to develop an existing ground profile and a proposed vertical alignment. If the vertical profile meets the design controls, it will then be checked for a balanced cut and fill along centerline. The contour lines can also be used to develop preliminary cross sections that will be used to estimate the total quantities of cut and fill

[33] *Geometric Design Projects for Highways, An Introduction, 2nd Ed.,* J.G. Schoon, 2000 – American Society of Civil Engineers (ASCE Press)

throughout the project. Field inspections may indicate grades or cross-slopes in excess of acceptable design standards and result in adjustments to the proposed centerline.

Conclusion

The Forest Service paper *Map 92337 talking points* asserts that it was the intent of Congress to absolutely fix the final centerline for the transportation and utility corridors as presented on *Map No. 92337* without regard to "any positional inaccuracy that may inherently be contained in the map." My position is that the congressional intent for *Map No. 92337* is to provide a general location for the TUC centerlines that would be refined by surveys and other engineering studies until a final alignment was reached that met the design controls and environmental constraints.

The previous discussion on mapping standards, legislative mapping and route location provide support for the proposition that while small-scale mapping may be useful for very generalized and schematic geographic location, it would be inappropriate for the purpose of engineering design and route centerline location. To use *Map No. 92337* for that purpose would be devoid of common sense, contrary to accepted engineering principles and lead to absurd results. Absolute adherence to the *Map No. 92337* centerline positions could result in a road centerline that traverses lands with unacceptable slopes, poor soils, environmentally sensitive areas and require the crossing of significant bodies of water when a slight realignment could minimize or eliminate those hazards. There is an old saying that "You can't make a silk purse out of a sow's ear." This means that you can't make a good quality product using bad quality materials. Yet this is exactly what the Forest Service proposes when it suggests that the accuracy of *Map No. 92337* can be improved such that the proposed alignment positions can be accurately extracted from it, located on the ground and held as absolute.

Great deference is given to the intent of the legislative body when a new law is enacted. In my estimation, the only way that Congress could accept the Forest Service's interpretation of their intent would be if Congress had intended the reciprocal easement exchange to fail. Accepting the Forest Service assertion with regard to the *Map No. 92337* would lead to failure of the easement exchange and an absurd result.

Statutes are generally to be interpreted according to the ordinary meaning of their words. However, an exception to this rule arises when the interpretation would lead to absurd results. The exception is described in a publication of the *Brooklyn Law Review.*[34]

> The absurdity doctrine, also known as the Golden Rule doctrine, is an exception to the plain meaning canon. The absurdity doctrine allows judges to ignore the ordinary meaning of statutory text when that ordinary meaning would lead to absurd outcomes … Absurdity arises for a number of reasons, stemming from the difficulty of drafting precisely during a non-lineal legislative process … That reality can produce odd outcomes that are seemingly inconsistent with legislative intent.

There is nothing in the text of Section 4407 of the *SAFETEA-LU* highway bill that speaks to how the transportation and utility corridors graphically represented on *Map No. 92337* would be surveyed, engineered or located on the ground. The only reasonable interpretation of the Congressional intent in this law is that common sense and long accepted engineering procedures would be applied to ensure the location of functional, economical and environmentally appropriate centerline alignments that would then be secured by the granted easements. As presented, the Forest Service proposal is not based on either common sense or long accepted engineering principles.

Respectfully submitted:
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[34] Linda D. Jellum, *But That Is Absurd!: Why Specific Absurdity Undermines Textualism,* Volume 76 Issue 3, 2011.