MEMORANDUM

State of Alaska
Department of Transportation & Public Facilities
Northern Region Design & Engineering Services

TO: Duane Doerflinger, PE
Preconstruction Standards Engineer
D&ES HQ

DATE: 5/20/02
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FROM: John F. Bennett, PLS, SR/WA
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SUBJECT: Survey Control Sheets

Based upon your 5/10/02 e-mail request for comments regarding the survey control sheet issue, I offer the following:

1. Personal experience with surveying standards: I don't usually start a memo with my resume, however, in this case I believe it is important to note that this is a subject that I am fairly close to and take seriously. I am an Alaska licensed professional land surveyor (PLS), a United States Mineral Surveyor (USMS) and a designated senior member of the International Right of Way Association (SR/WA). My degree from the University of Alaska (Associates) is in Surveying Technology. I am a past president of the Alaska Society of Professional Land Surveyors (ASPLS) at both the state and chapter levels. I have been the Chair of the ASPLS Standards of Practice Committee since 1994 when I produced the current (4th edition – 1994) of the ASPLS Standards of Practice Manual. This manual is cited as a surveying standards reference in a variety of specifications including some DOT&PF specifications. I am the webmaster of the ASPLS Website www.ptialaska.net/~aspls which acts as an electronic repository for ASPLS standards and other surveying information and produced the 2000 ASPLS Surveying Reference CD. I have presented the papers Highway Rights of Way in Alaska (1993) and Highway Right of Way Surveys (1996) at the Alaska Surveying & Mapping Conference and various other seminars. I was the Northern Region Right of Way Engineer and supervisory land surveyor between October of 1986 and July of 1999.

2. *Is there a need to provide a survey control policy? (Are there cases where we have negligently constructed projects outside our ROW in the past? Is there statutory or regulatory incentive for revision of our policy? etc.)*

   By virtue of the current confusion and controversy regarding survey control, I believe a policy statement is appropriate. A policy would also facilitate management's desire for consistent and uniform practices throughout the regions.

   I can cite several examples in the Northern Region where I know the physical road to be constructed outside of the right of way, where I suspect the road may be outside of the right of way or where the ROW plans and construction as-builts are in conflict and could potentially lead to a trespass situation. These situations often arise due to a non-survey procedural error rather than a survey error. Some scenarios include:

   - Distraction – for lack of a better word, the Department was distracted from completing an acquisition and a road was constructed in trespass. Example:

Pitka's Point Road (LSR&T 1970's) – allotment acquisition was appraised but never acquired.

- Construction Realignment – Construction realigns the design centerline due to field conditions and ROW is not informed. Example: Badger Road (1960's) – centerline realigned by 5' for 3 miles and monumented. Developers over the next 30 years use construction centerline as ROW centerline and a 5' gap/overlap is created along the road.
- Misinterpretation of Existing ROW: Ambiguous documentation for existing rights of way often leads to conflict. Example: McCarthy road (current) – Legal opinion changes historic assertion of a 200' wide ROW to 100' resulting in slope limits falling outside of right of way.
- Faulty Control Survey: Circumvention of procedures can result in a defective survey. Example: McGrath Road Bikepath (1990's) – Identification of a defective control survey after ROW acquisition is completed results in a second round of ROW acquisition along the length of the project.
- Improper Use of Survey Control: Rather that using the control established and referenced during the design survey, the plans designate only two horizontal control points and direct the contractor to reestablish the centerline control from these points. Example: Farmer's Loop MP 0-8 (1980's) - The project right of way for was constrained to the point that the design slope limits were often coincident with the ROW line. The allowable tolerance in resurveying the centerline control over 8 miles likely resulted in the as-built slopes falling outside of the right of way in certain areas.

I believe that there is statutory incentive for the implementation of a policy that will ensure accurate control surveys and documentation. My concern is based on my experience with the views and attitudes that private sector surveyors have historically held toward the quality of DOT surveys and mapping. Certain statutes such as AS 9.55.275 Replat Approval, AS 35.30.020 Compliance with municipal ordinances and more recently Sec. 40.15.380. Applicability to governmental bodies; right-of-way acquisition plats, which require compliance by the department in the same manner as other land owners were likely the results of a perception that DOT surveying and mapping procedures were substandard. These statutes hold an agency whose mission is to provide safe transportation systems to the same standards as any other residential subdivider. I believe that complaints of monument destruction during construction activities and title conflicts created by ambiguous mapping resulted in the legislature placing controls on the department because the department was unwilling or was too slow to internally improve its procedures. Therefore, it is reasonable to expect that if the department does not pay attention to procedures and policies that will ensure the quality of its surveying and mapping products, we can expect more restrictive legislation that will further slow the project development process and make our jobs more difficult.

3. *Can procedural improvements be made by implementing a survey control policy? (Can we improve design time and cost effectiveness by creating a survey control policy? Can we reduce construction costs by implementing a survey control policy?)*

The problem is that Design perceives the production of survey control sheets as an impact on design time and cost effectiveness while I believe there are significant cost benefits to

construction by providing comprehensive control information. Limiting the basis of horizontal control statement to two control points may reduce the level of effort needed to prepare a set of plans, however, it significantly increases the effort by the construction surveyor and does not provide the redundant checks necessary to ensure that the control is good. If you traverse between two control points, you can tell whether the distance between the points is in error but you can't tell which point is in error. Also, one of the points could be physically moved such that the distance between the two remained the same but the bearing between the two changes. Relying on only two control points for accurate location of a multi-million dollar facility is poor practice. Conceivably, tens of thousands of dollars were spent to recover existing control and boundary monuments and to layout the design control line. It seems absurd that this investment should be wasted and the control information hidden from the contractor. This would result in significant increases in costs due to the redundant labor necessary to perform another control survey as well as an increased potential for introduction of additional error into the control. A policy that requires DOT documentation and contractor utilization of the design control survey data will reduce costs to the public both directly and indirectly.

I also believe that control sheets can be produced in a timely manner without an impact on the design schedule. One procedure for development of control sheets (Central Region process) requires the scheduling of resources by Locations for two periods of time. First a "survey control diagram" is produced by Locations upon completion of the field work. This document reflects the recovered and set control and boundary monuments. It is delivered to Design along with the topographic survey data. At some point when the design centerline is solidified and no further revisions are expected, Locations will edit the "survey control diagram" into a "survey control sheet" that includes the final centerline. Dave Bloom was concerned that this conversion process to the "survey control sheet" would delay the design schedule as it would require additional resources from Locations at a time when they might not be available. The Northern Region solution to this was to end the Locations involvement at the "survey control diagram" stage. A coordinate summary of the final design centerline/control line PC's PT's and RP's would be placed on one of the design plan sheets. The relation between the survey control sheets and this table would allow a construction surveyor to lay out and check between most any point on the control and the design line. There would be no additional work required of Locations beyond the initial control sheet submittal.

4. *What should the elements of any new policy be and what form should it take (guidance in the PCM? Guidance in the ROW manual? Both?)?*

   It might be appropriate to have a reference in the ROW manual, however, this situation is a bit atypical for ROW as it results in the placement of plan sheets, sealed by a professional land surveyor into the as-advertised package. I believe once this is worked out, the appropriate place for the policy would be in the Preconstruction Manual.

I would also like to add a few more comments based upon some of the discussion I have heard recently on this subject. Some of the comments I have heard are:

- *There are too many sheets for the control survey* – Certainly the number of sheets can't be an issue so it must be the difficulty in accepting change. I am unaware of

any restrictions on numbers of sheets in a plan set for either the primary design or the support groups (bridge design, lighting, etc.) The real question is whether the information is necessary and how it can be presented efficiently and accurately.

- *The control sheets require a PE stamp as per Alaska Statute* – I suspect this is a misinterpretation of the statutes. AS 8.48.221 Seals states *that "When a registrant issues final drawings, specifications, surveys, plats, plates, reports, or similar documents, the registrant shall sign the documents and stamp the document with the seal*". The commentator apparently believes that every sheet in the plan set must be sealed by the design engineer whether it falls under civil design, land surveying, architecture or another branch of engineering. This statute further states *"The registrant, by affixing the registrant's seal to final drawings……and signing them, certifies that these documents were prepared by or under the registrant's direct supervision, unless the registrant certifies on the face of the document to the extent of the registrant's responsibility.*" As the survey control sheets were not prepared under the design engineer's direct supervision, their seal could not be placed upon the survey control sheets without a statement that they had no responsibility for the preparation of the document. This would be a somewhat bizarre use of a seal. Although the "practice of engineering" includes the "direction of or the performance of engineering surveys…", the fact that "survey control sheets" in most situations relate to the recovery and preservation of existing boundary and right of way monuments means that the production of such plats will fall under the "practice of land surveying". Attached is a scanned image of a cease and desist order from the Division of Occupational Licensing to an engineer who sealed a "survey control sheet". The drawing was considered by the Board to constitute the "practice of land surveying. *(Note: This letter was a private communication and is transmitted only to illustrate the position of the licensing board with regard to survey control sheets. It should be considered for this policy discussion but should not be not distributed beyond your desk.)*

- *Providing complete control information will increase the department's liability.* – I can't imagine that providing incomplete information is a defense against liability. The logic here is that the more information we provide, the greater probability that some of the information will be in error. Given that the design and acquired right of way was already based on this survey data, providing the complete survey data to construction will not lessen the impact of erroneous information.

- *Take the control sheets out of the plan set and note that they will be made available to the contractor upon request* – If the critical issue is really the number of sheets in a plan set, then I wouldn't have a problem with this proposal. However, I would only support it if all reference to control information were removed from the plan set. This is the only was a contractor's surveyor will be forced to request and use the complete survey control. Although our construction specs require a licensed land surveyor to be in responsible charge of the surveying for our projects, you will always find someone who will try to lay the project out using the two designated horizontal control points and a $100 handheld GPS unit from WalMart. Control of the horizontal and vertical location of the project is as important as control of materials,

environmental commitments and other critical elements of a construction project. The control information should be made available directly and not by reference.

- *Why is so much information required? These are not control drawings, they are reduced field notes. Why the new format? What has changed? We never had a problem in the past, why is there a problem now?* – These are the catch-all questions. In some respects many things have changed and in some respects the control sheets we are producing just represent a different view of the information we have always provided.

  What is the same? – The need to provide complete and accurate control information to construction. In 1973 I worked on the Locations survey crew on the Richardson Highway, Shaw Creek to Canyon Creek project. In 1974 I was a party chief in construction on that same project. As long as DOT performed construction surveys in-house, the hand off of control survey data was fairly straightforward. For one thing, the technology of the day required centerline staking and referencing that could be accomplished with a standard transit and chain. Preliminary "L" lines were staked and referenced in the field. This resulted in the production of standardized control and centerline field books that could be transferred directly to construction along with "O" line revisions generated by Design. One downside to the "L" line staking was that subsequent centerline revisions required the use of equations. However, with the use of common staff, common procedures and relatively low-tech techniques between Locations and Construction, there was little ambiguity with the control. Occasionally, the reference data was transferred directly from the field books to the plan sheets. This process was disrupted significantly in about 1976 when pressure from the private sector resulted in DOT turning over construction surveying to the contractor. We no longer had common staff or procedures and the flow of information became a bit more difficult. The current survey control sheets really do not provide much more than what was in the field books or plans sheets back in the '70's. However, with the changes in technology, law and increased professional and technical standards, the format in which the information is provided has changed.

  What has changed?

  1. Legal Obligations – As I mentioned earlier, there are a variety of statutes that require compliance with local government planning, platting and zoning requirements. In addition, AS 19.10.260 requires replacement of permanent markers and the filing of a ROW map after construction; AS 34.65.030 – 040 requires the recordation of Records of Survey and Records of Monuments as appropriate; AS 38.95.160 requires that surveys of state land be performed by a licensed land surveyor; and AS 38.95.160 requires the use of licensed professionals under AS 8.48 for any publicly financed improvement on state land costing more than $100,000. In addition, platting obligations, including ROW acquisition platting, now extend to the Unorganized Borough along with every other Borough or city authorized under state law to manage such activities. Some states that I have contacted such as Washington and Idaho are exempt from local government oversight with regard to platting and in some circumstances, continue

to be exempt from professional licensing requirements. Alaska DOT is not only subject to such requirements, but is often held to a higher standard.

2. Professional Requirements - Prior to 1972 (Section 6, ch 179, SLA 1972), engineers holding valid registration were entitled to perform and seal land surveys. From this point forward, land surveyors were licensed through examination; however, engineers were eligible for a "grandfather" land surveyor's license. Due to this "grandfather" clause, DOT&PF technically had dozens of licensed land surveyors on staff although few had practiced or were practicing land surveying as a part of their job. Most of the "grandfathered" land surveyors have since retired from DOT with the last one in Northern Region leaving in 2001. Prior to 1981 state employees were effectively exempt from the professional licensing laws. CSHB272 effective 10/14/81 continued to provide the exemption if registration was not required by the person's job description, however, the head of each principal department was then to specify which positions required licensing unless waived by the head of the department. CCHB182, effective 5/2/90, eliminated this waiver provision and provided for a transitional period ending 12/31/91 after which any state employee practicing "architecture, engineering, or land surveying" was to meet the registration requirements according to AS 8.48. Prior to my joining the Northern Region in 1986 as the regional right of way engineer, the ROW Engineering section had not been supervised by a licensed land surveyor and the technical capabilities of the staff was limited. In fact the ROW plans were being sealed by a licensed land surveyor who was an employee of DOT, however, he worked in another section and was not in responsible charge of the section. Today, the ROW Engineering /Locations sections have 9 surveying & mapping positions. Of these 9 positions (not including my own), 6 are filled with licensed land surveyors, 1 is an LSIT, and another has just sat for the full LS exam. I believe the other regions have staffed their positions with professionals in a similar manner. In the 1970's and 80's DNR was the major employer of public sector licensed professional land surveyors in Alaska. With the reduction in oil money and land disposals, DNR's presence has waned and now DOT leads the state agencies with its professional land surveying staff. The relatively new presence of a dedicated professional land surveying staff within DOT has allowed us to recognize that while certain practices may have been acceptable in years past, particularly in the less developed areas of the state, professional obligations now require reconsideration of our procedures and improvement of our work product.

3. Surveying & Mapping Technology – The transit and chain survey, the station & offset coordinate system and standardized field notes for control line references and curve layout are for all intents and purposes a thing of the past. Increased labor costs, accuracy requirements and mass data handling has taken us into the realm of electronic total stations and bar code levels, real time kinematic GPS systems, and topographic mapping based upon triangulated irregular networks (TIN). Data is coordinate based, often Alaska State Plane, and requires processing through a variety of software packages before it is ready to turn over to design. Often, a random control line is established as opposed to the historically staked "L" line and "references" may be a mix of established points or ties to

recovered monuments. Data is electronically collected, so there are no field books in the conventional sense to pass along to the construction surveyor. The "survey control sheets", however, serve to pass the necessary horizontal and vertical control data to the construction surveyor in a format that is more suitable for modern staking technology.

4. Expectations of the public, professionals and local governments – DOT surveying and mapping procedures have traditionally been focused upon meeting the requirements of our mission. That is, the development of plans for ROW acquisition and construction. Little thought was given to the preservation of boundary evidence that was often destroyed in construction or the increased complexity of surveying a property that had been the subject of a ROW acquisition. The boundary monuments and property description represented a portion of the value of the property that often would have to be replaced at a greater expense once DOT had passed through. Most private surveyors and local government officials involved in platting have anecdotes of the difficulties surveying land bounding on DOT rights of way. To be fair, much of DOT's past surveying & mapping practice was appropriate for a developing state that was primarily rural in nature. However, the perception is that DOT's practices did not advance, technologically or professionally as the land use density and land values increased. The public still wants new roads and airports, but they also want to preserve their investment in the existing surveying and mapping systems. And to that end, DOT must assure that it is giving due consideration to this issue.

5. Technical Standards – Although this is partially covered in other sections, many of the technical standards that had been accepted for years are no longer appropriate. For example: The traditional method of surveying for ROW acquisition plans was to tie a few corners of each subdivision or section (rectangular) and then compute the missing boundaries and corners from record information. As we are now required under certain platting ordinances or negotiated settlements with property owners to set property corners on the new ROW line, it is necessary to perform a retracement of existing boundaries that would be sufficient to allow new corners to be set.

We never had a problem in the past, why is there a problem now? - Unlike a catastrophic failure of a civil or structural design, significant defects in land surveys are generally not visibly apparent. Whether the errors occur during the Locations phase, the ROW mapping phase or monumentation of the right of way, they can go unnoticed until revealed by a subsequent survey years later. A significantly defective survey, which can cause title and boundary conflicts with adjoining properties for years to come may be the same survey that results in a perfectly drivable road. In other words, the fact that the facility was successfully constructed does not mean that the survey was performed successfully. There have been many anecdotes of large survey busts found by construction that were dealt with by transitioning the error out so it was imperceptible to the eye. The problem exists to a greater extent than most people know and can only be addressed through the use of correct procedures and adherence to appropriate standards.

Summary: Depending on your point of view, the level of controversy regarding the control survey issue ranges from a discussion of appropriate technical and professional standards to a turf war. Given that we all have more than enough work to do, we should focus on determining the appropriate standards that will effectively and accurately allow us to transfer the control data to construction while meeting our professional and legal obligations. As the department has seen fit to develop its surveying staff into the strongest professional land surveying group in state government, it should give due consideration to their judgement and proposals relating to surveying & mapping issues. My recommendation is that the three regional ROW Engineers and the three supervisory Locations surveyors collaborate on a set of standards for survey control sheets that satisfies our legal, technical and professional obligations and then place these standards into the PCM. Differences of opinion will arise with our design counterparts and they should be worked out to the extent possible. However, it must be recognized that our staff professional land surveyors are in responsible charge for those activities encompassed within the "practice of land surveying" and therefore their advice should be given the appropriate weight.