

STANDARDS FOR ESTABLISHING & MODIFYING
PHYSICAL ROAD NUMBERS
MILE POINTS & POINT IDENTIFIERS IN THE
MICHIGAN GEOGRAPHIC FRAMEWORK
TRANSPORTATION REFERENCING SYSTEM

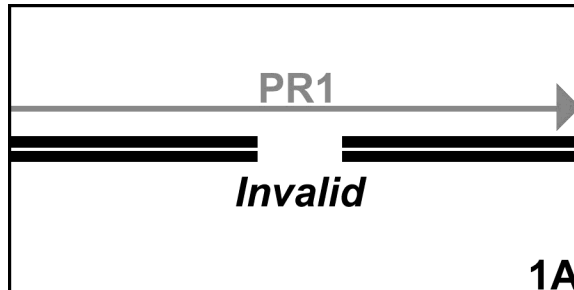
MICHIGAN DEPARTMENT OF TRANSPORTATION
IN COOPERATION WITH THE CENTER FOR GEOGRAPHIC INFORMATION

SECTION 1: PHYSICAL ROAD (PR) DEFINITION AND PROPERTIES

Physical Road Numbers (PRs) are numeric identifiers assigned to represent segments of the road, rail and nonmotorized transportation network, physically traversable by wheeled vehicles.

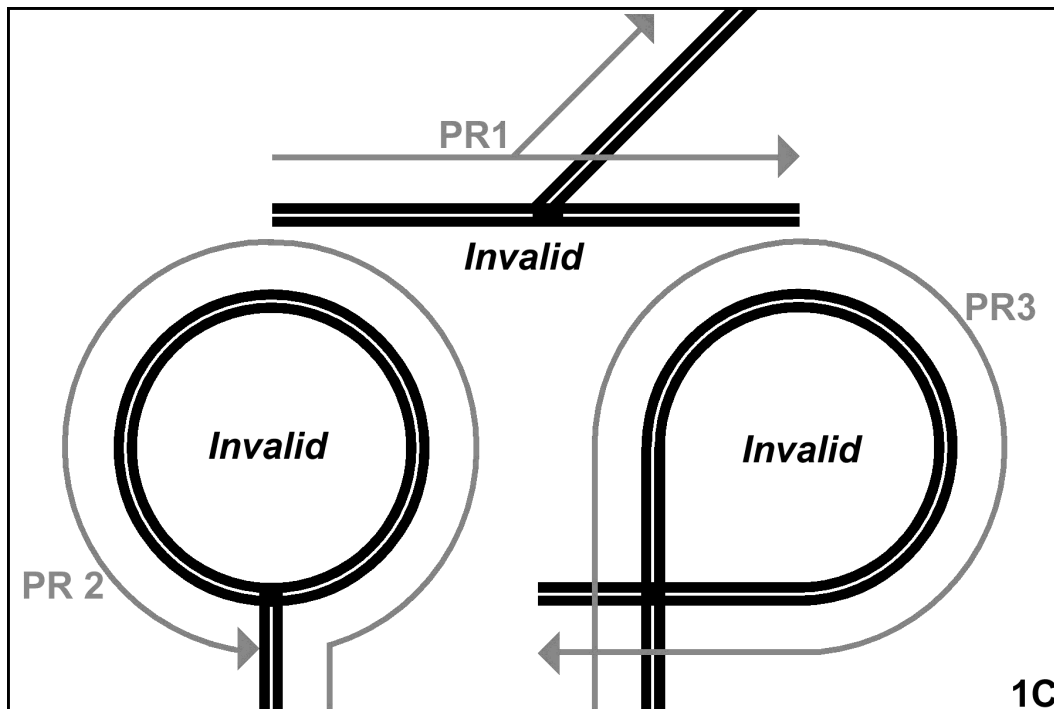
PRs have the following properties:

- A. PRs are continuous with no gaps or overlaps. Unconnected segments cannot have the same PR.



- B. PRs have one beginning and one end. The beginning is assigned the zero mile point. PR's have only one direction.

- C. PRs have no branches or loops. PRs never extend from a point or converge on a point along more than two paths.



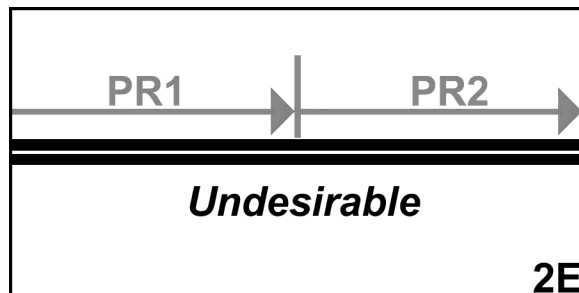
- D. Each PR refers to a unique segment of the transportation system, and no segment has more than one PR. PR aliases are not part of the *PR Master*. A retired PR number cannot be reused later for a different segment.

SECTION 2: IDEAL FORM OF A PHYSICAL ROAD NUMBER

The official record of the PRs is stored in the Michigan Department of Transportation (MDOT) *PR Master Table*. PRs may contain curves, straight elements and angles. The ideal is: "One segment. One PR." However, one PR may extend around corners on several segments along a route. In the case of divided roads such as freeways and boulevards, or related rail lines and trails which exist on separate roadbeds, each side must have a separate PR. A PR should extend as long as possible on the same continuous transportation segment. All public road segments 26 feet or more will receive a PR.

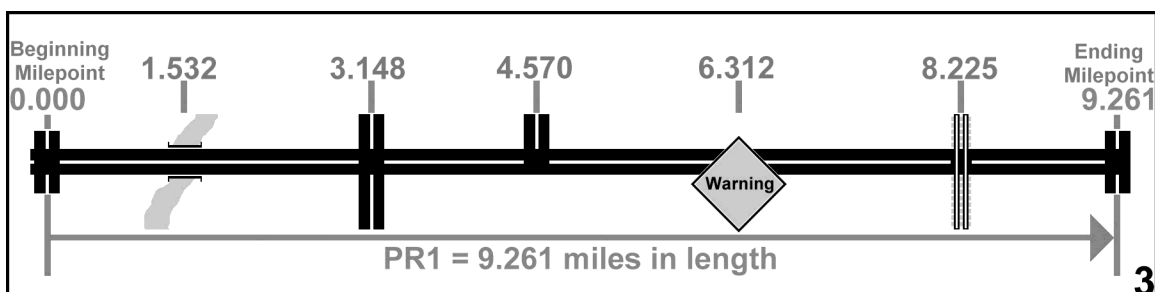
Guidelines for creating PRs:

- A. Create fewer new PRs.
- B. Create longer PRs.
- C. Start PRs at intersections with another PR.
- D. Keep existing PRs on their original alignment.
- E. An artificial PR break is a point where one PR ends and another begins and no other PR meets. Artificial PR breaks are not considered intersections. Artificial PR breaks should only be created if necessary to prevent a loop in one PR.



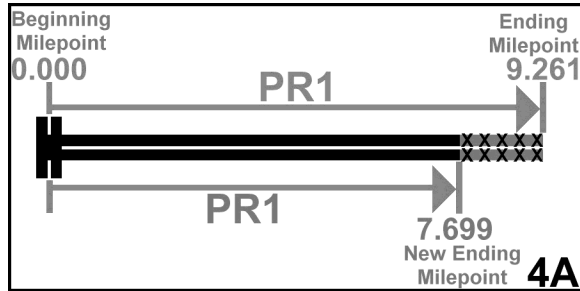
SECTION 3: MILE POINTS

- A. All PRs start with the zero mile point. For new PR's the zero mile point is at an intersection with another PR. (See 9H.)
- B. Each intersection of the PR with another PR has an absolute mile point to indicate its distance from the beginning of the PR.
- C. The mile point of the end point of the PR is always the length of the PR.
- D. All mile points may be remeasured at any time in the history of the PR. The official mile points depend on the time stamped version of stored in the MDOT *PR Master Table*.
- E. The mile points serve the important function of sequencing the intersections along the PR. Even if the mile points change, the relative order of the mile points for any two intersection PRs along a PR never change in the referencing system except to correct an error.
- F. A principle of PR mile points is that they will always be able to be measured from some field identifiable marker; usually an intersection. The zero mile point should start on an intersection. When markers are obliterated, mile points cannot depend on them. The ability to measure the location of all points on the network at any time must be maintained.
- G. Once a PR mile point has been assigned to a point, that same PR mile point cannot be reassigned to a different geographical point except in the case of distance correction.
- H. The *PR Master* and the current *Michigan Accident Location Index (MALI)* include the length in whole feet of each segment between intersections. The mile points of intersections along the PR are calculated by accumulating the total distance in feet from the beginning of the PR, dividing by 5,280 and rounding. TMS and the *PR Master* will represent the mile points to three decimals. Other applications may use the same calculation method to represent mile points in more or less than two decimals.
- I. When the above procedures allow for designation of either end of a segment as the zero mile point, the end least likely to be obliterated or supplemented with additional mileage should be designated as the zero mile point.

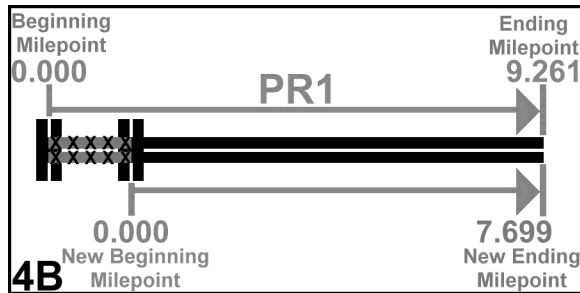


SECTION 4: OBLITERATIONS

- A. When an obliteration occurs at the end of a PR, the PR will stay the same except it will have a new end point. The new length of the PR will be shortened.



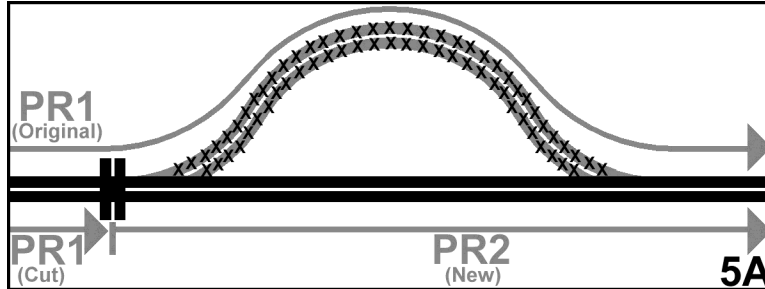
- B. When an obliteration occurs at the beginning of a PR, a new PR will be assigned to the remaining old PR. The old PR mile points cannot be retained because the PR must start at zero and the beginning field identifiable marker is gone (See item 3F). The old PR number cannot be reused with new mile points starting with zero at the new beginning because that would reassign an old PR and mile point to a new geographical point (See 3G).



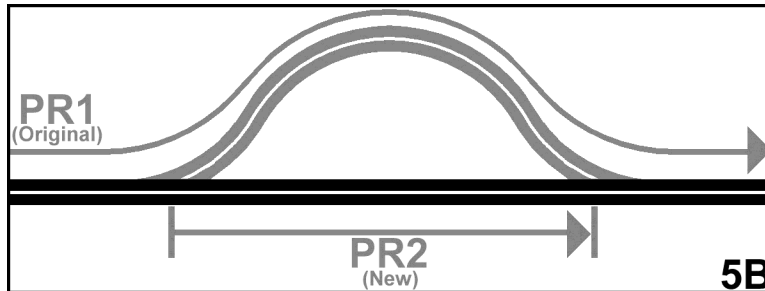
- C. PRs representing a segment of railroad will not be obliterated until all legal proceedings are complete and trackage has been removed from the roadbed.

SECTION 5: RECONSTRUCTION

- A. When a curve is reconstructed and the old roadbed is physically obliterated, a new PR will be assigned from the intersection at or before the starting point of the new construction to the end of the original PR.

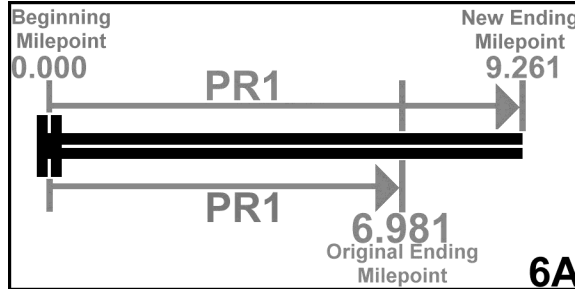


- B. When a new bypass is created inside a PR which connects at two or more points of the old PR, and the old segment remains intact, the new bypass will receive a new PR and the old PR will remain unchanged.

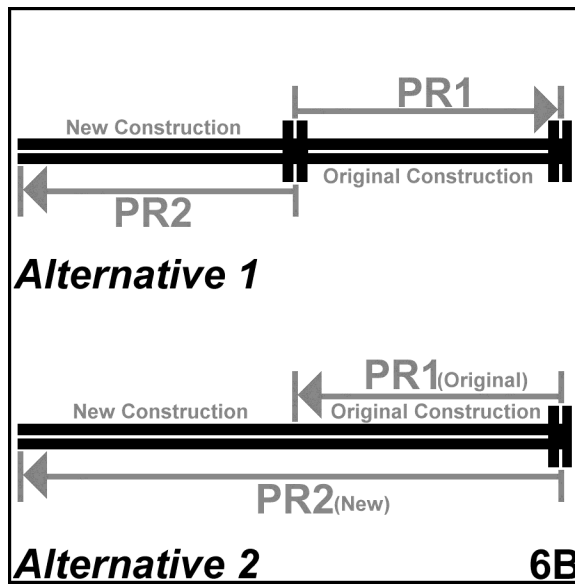


SECTION 6: EXTENSIONS TO EXISTING PRs

- A. When new construction is added to the end of a PR, the mile points will remain the same along the original PR. The new construction will extend the PR to a new end point and a new total length.



- B. When new construction is added to the beginning of the PR (usually an extension to the west or south), a new PR may be assigned to the new construction. Alternately, the entire continuous segment, including the new construction and the old segment, may receive a single new PR.



SECTION 7: DIVIDING AND UNDIVIDING

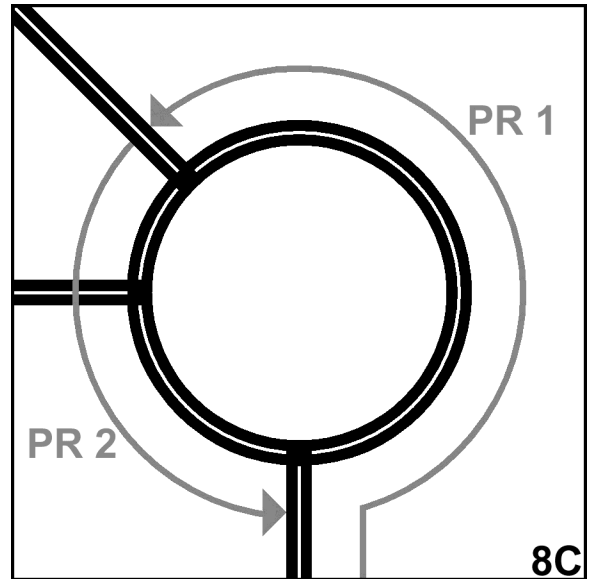
- A. When a divided road or railroad that had one PR is given two PRs, the new PR is assigned to the south or westbound segment.
- B. When a road or railroad fluctuates between divided and undivided, each divided segment receives a new southbound or westbound PR. If the fluctuations are short, the road or railroad may receive one or two PR's depending on the predominating form. The decision is case by case.
- C. When divided roads have the median replaced with a drivable lane, they become undivided. The westbound or southbound PR will be removed.

SECTION 8: LOOPS, TANDEM PRs, DUPLICATE PR-CROSS-PR AND POINT IDS

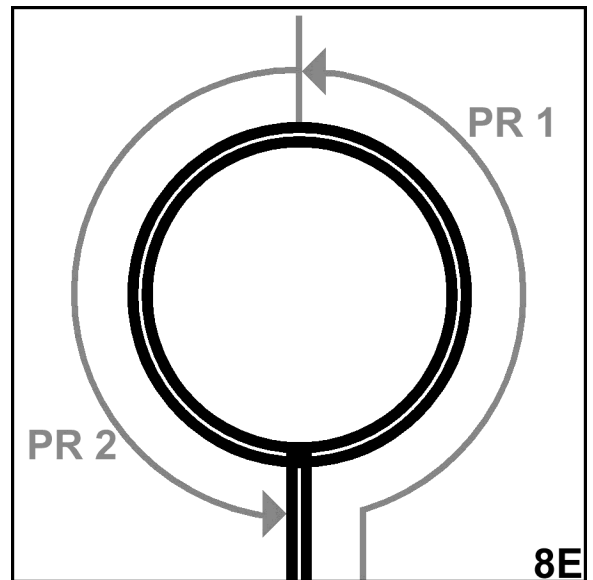
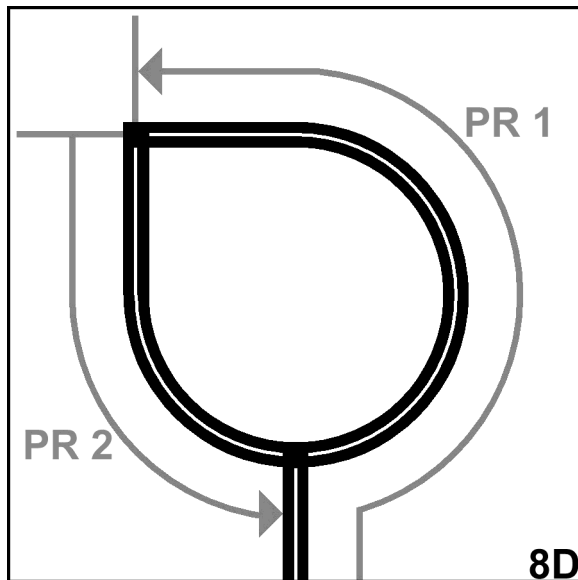
A. Any path through the network that starts at a point and returns to that same point without passing along the same segment more than once is considered a loop in the transportation network, regardless of its shape or complexity. A single PR cannot contain a loop.

B. Some segments loop back and contact themselves. Every loop needs at least two PRs. Two PRs created on one segment simply for the purpose of preventing a PR from contacting itself are called tandem PRs.

C. When tandem PRs are required by a loop, their junction will occur at the PR intersection nearest the loop midpoint, if any intersection exists.

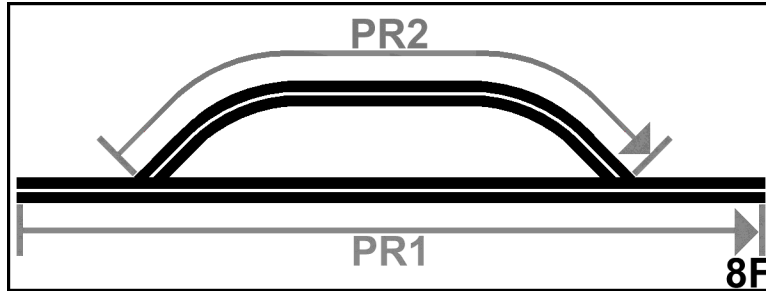


D. When no intersection occurs in the loop, the tandem PR junction will occur at a distinct corner or at a place where the loop changes names if possible.



E. When a loop occurs without any of the above natural markers, the tandem PR junction will occur at a fixed distance equal to half the measured length of the loop. The second tandem PR will still start with zero. All points on the second PR will be measured by measuring from the beginning point of the first PR and subtracting the fixed length of the first PR.

- F. When loops contain only two PRs, these two PRs cross twice. Examples of such loops are horseshoe drives, rest areas and boulevards. In these cases, the PR and cross PR do not identify a unique point. Each point in the Statewide PR network has a unique Point ID in the MDOT *PR Master*. These point IDs uniquely identify both points on the loop where the PRs contact each other.



- G. A point ID can never be reassigned to a different point. However, point IDs can be retired from the current *PR Master Table* if the point is obliterated.

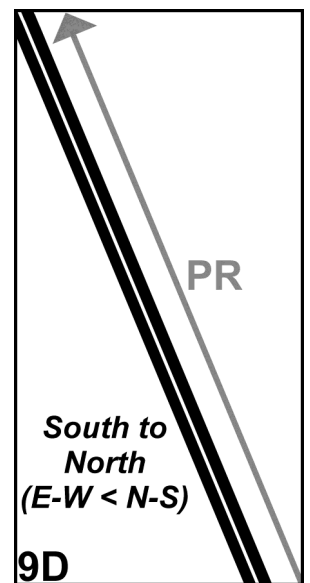
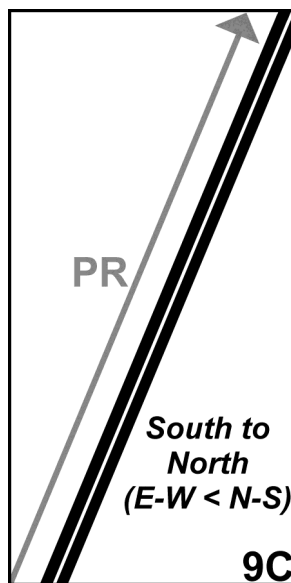
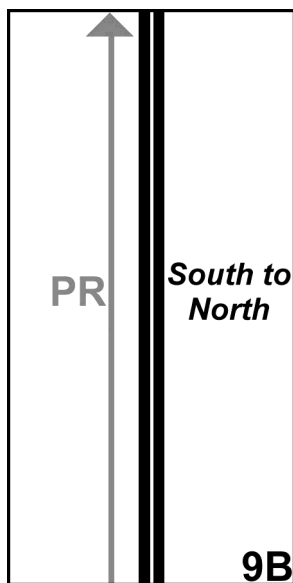
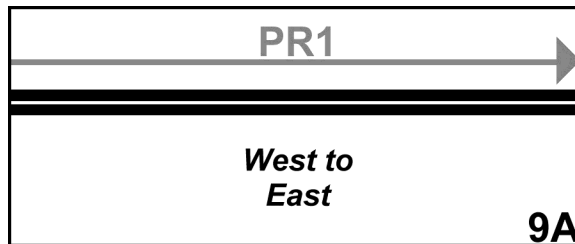
SECTION 9: PR BEGINNING POINTS

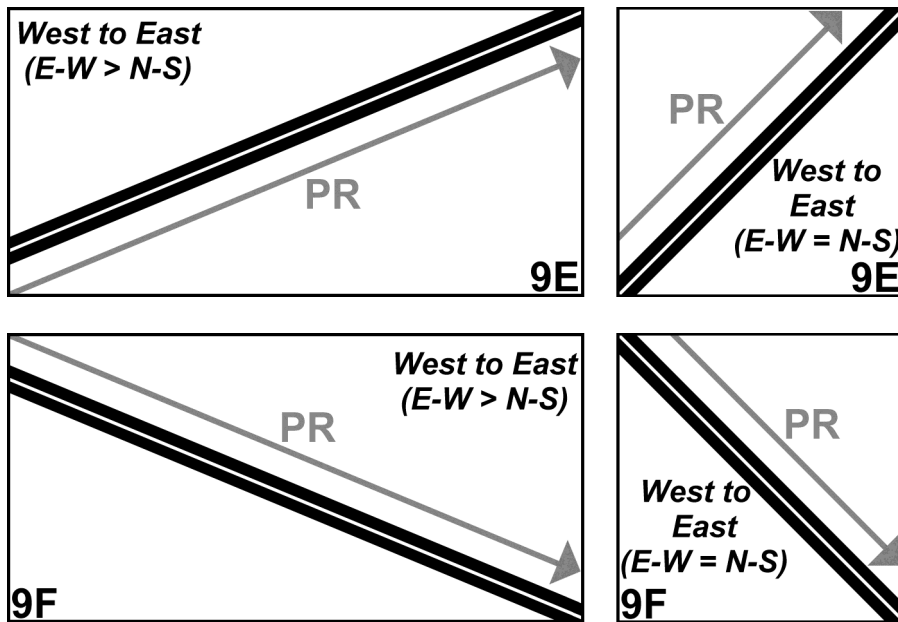
The *Box Rule* for finding the starting point of a PR is as follows: Draw a rectangular box with east-west and north-south sides and opposite corners on the two PR endpoints. The box can collapse to a north-south or an east-west line. The PR can stray outside the box. If the box is taller than wide, the PR normally begins at its south point. If the box is square or wider than tall, the PR normally begins at its west point.

The *Box Rule* formula in Geographic Information Systems (GIS) uses the longitude and latitude. The north-south latitudinal difference is multiplied by the cosine of the latitude to adjust it to the scale of the longitudinal difference for comparison of the sides.

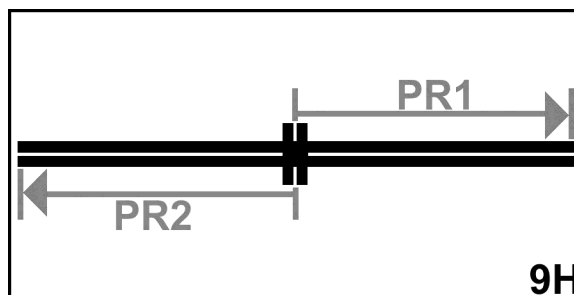
If the east-west distance (longitudinal displacement) between the end points of a PR is greater than or equal to the north-south distance (latitudinal displacement), then the west point is the from point and the east point is the to point. Otherwise the south point is the from point and the north point is the to point.

End Point Orientations	From Point	To Point	PR Direction
A. West to East (same latitude)	West	East	W-E
B. South to North (same longitude)	South	North	S-N
C. Southwest to Northeast	E-W dist. < N-S dist.	SW NE	S-N
D. Northwest to Southeast	E-W dist. < N-S dist.	NW SE	S-N
E. Southwest to Northeast	E-W dist. ≥ N-S dist.	SW NE	W-E
F. Northwest to Southeast	E-W dist. ≥ N-S dist.	NW SE	W-E





- G. In the case of trunkline routes, PRs increase in the direction of the route as established by *Control Section*, even if the direction is south or west. Spur routes to state parks typically proceed from the trunkline out to the park. If part of the PR is on the trunkline and part is off the trunkline, an attempt will be made to make the PR go in the trunkline direction. Roads with two trunkline segments with opposite trunkline route directions require different PRs.
- H. New PRs must start at an intersection with another PR. New PRs do not start at dead ends or cul-de-sacs. If the normal starting point of the new road would not be an intersection with another PR, that point should be an end point of a PR. In this case, two new PRs will be assigned, both starting at the first intersection. The stub PR will have only one intersection and run opposite the usual direction.



SECTION 10: COUNTY LINE SEAMING

- A. All county line PR aliases will be removed from the *PR Master*.
- B. In special instances, PRs can cross county lines. Separate attributes will indicate county and jurisdiction.
- C. Trunkline road, railroad and nonmotorized PRs will normally break at county lines even if there is no intersection.
- D. New nontrunkline PRs will only start at intersections.

SECTION 11: ABSOLUTE AND RELATIVE REFERENCING

- A. Absolute referencing identifies a point by a given distance along a PR from the beginning of the PR.
- B. Relative referencing identifies a point by a given distance from the nearest intersection along a PR.
- C. Absolute referencing only needs one reference element (PR) and one distance to place any point on the roadway. Relative referencing needs two reference elements (PR and Point ID) and one distance. However, when the point occurs at an intersection, the relative referencing distance is zero. Absolute referencing can be considered a subset of relative referencing in which the implied Point ID is the PR beginning point. Absolute referencing has a unique identifier for each point. Relative referencing can start from some point other than the nearest one. And the relative distance can be negative. Absolute and relative referencing complement each other rather than replacing each other.
- D. The main purpose of relative referencing is to help solve the problem of cross year and cross application comparisons between databases as the PR referencing system changes from one version to another due to remeasurement, obliterations, reconstruction, topological corrections and road model changes.